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THE EFFECT OF LIGATION OF THE COMMON ILIAC ARTERY ON THE CIRCULATION AND FUNCTION OF THE LOWER EXTREMITY.

REPORT OF A CURE OF ILIO-FEMORAL ANEURISM BY THE APPLICATION OF AN ALUMINUM BAND TO THAT VESSEL.

By W. S. Halsted, M. D.,

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The purpose of this paper is not so much to publish a case in which a cure of ilio-femoral aneurism was accomplished by the application to the common iliac artery of a barely or completely occluding aluminum band as to consider the reasons for the view which prevails that ligation of this artery is an exceedingly dangerous procedure and likely to be followed by gangrene, and to determine, if possible, the ultimate result of this operation so far as usefulness of the limb is concerned.

I have endeavored to assemble all the cases of ligation of the common iliac artery reported since 1880, accepting, in order to avoid confusion, this arbitrary date, proposed by Dreist[1] as being within the antiseptic period. Although antiseptic surgery was not universally practiced until after 1890 in the United States and Great Britain, the countries which have contributed most to the surgery of the common iliac and of the other large arteries, infection has not played part enough in the cases here collected to obscure the factors responsible for the results and thus prevent the drawing of deductions concerning the matters which it is the particular purpose of this paper to consider.

In the years from 1880 to 1912, the common iliac artery has been ligated at least 30 times, or about once a year, for the control of hemorrhage and the cure of aneurism.

Undoubtedly the reports of some have been overlooked by me and the number of unpublished cases may be considerable. The Index Medicus has been of the greatest assistance in my search, not one of the cases found in other medical bibliographies having been overlooked by this indispensable work. Only three of the published cases of my list are not to be found in the admirably arranged and marvellously accurate index of the Index Medicus and there is good excuse for the omission of these, there being no titular indication of their existence.

Thanks to the courtesy of Dr. McCaw, the library at Washington of the Surgeon-General has been at my disposition, and not one of the desired articles has been wanting from its shelves. This privilege has enabled me to make an abstract from the original article in every case.

The common iliac artery was ligated for the first time July 27, 1812,[2] *just one hundred years ago,* and in this period it has been tied about 100 times.

The original operation was performed for the arrest of hemorrhage, by William Gibson,[3] at that time Professor of Surgery in the University of Maryland, Baltimore. The patient was a male, æt. 38. A musket ball entering the left side of the abdomen passed through the intestine, opened the left common iliac artery and lodged in the sacrum. Peritonitis developed promptly. On the ninth day a severe hemorrhage occurred. From this time, until the death of the patient, on the fifteenth day after operation, there were repeated hemorrhages.

[1] Deutsche Ztschr. f. Chir., 1903, LXXI, Heft 1, 26.

[2] Am. M. Recorder, 1820, III, 185.

[3] Dr. Gibson performed this operation at the age of twenty-four. It was due to his efforts that, the previous year, the Medical School in which he held the Chair of Surgery was founded.

Valentine Mott was the first deliberately to tie the common iliac artery. The operation, undertaken for the cure of iliofemoral aneurism, was successful. The story of the case as related by him is impressive and gives one some idea of the courage, skill, sagacity and resourcefulness of this remarkable man.

The following passages are quoted from Dr. Mott's report:[1]

"On the 15th of March, 1827, I was requested to visit a patient with Dr. Osborn (of Westfield, New Jersey, about twenty-five miles distant from New York) whom we found laboring under a large aneurism of the right external iliac artery.

"Israel Crane, aged 33 years, says that about the middle of January he felt some pain about the lower part of the belly, which he attributed to a fall received during the winter.

"It, however, was not until a fortnight since, that he perceived any tumor about the lower part of the abdomen. Upon examination, the abdomen on the right side was considerably enlarged from about the crural arch, as high as the umbilicus. When the hand was applied to the parietes of the abdomen a pulsation was felt and rendered visible to some distance. To the touch, the tumor beat violently and appeared to contain only fluid blood. It commenced a little above Poupart's ligament and reached, judging by the touch, from without near the navel—inwards, almost to the linea alba—outwards and backwards filling up all the concavity of the ileum, and reaching beyond the posterior superior spinous process of that bone.

"The rapid increase of this aneurismal tumor occasioned, as the countenance of our patient indicated, the most extreme agony. His sufferings were at times so great that his screams could be heard at a distance from the house. He had been bled several times, taken light food, and was kept constantly under the influence of opium. He was now informed of the serious nature of his case, and that without an operation very little chance of his life remained. With great composure he immediately consented to whatever would give him the best prospect of saving his life.

"From the extent and situation of the tumor, he was apprised of the uncertain nature of the operation, as well as the difficulty of performing it, and indeed that it would require an artery to be tied, which never had been operated upon for aneurism.

"With these views of his situation, he cheerfully submitted to be placed upon a table of suitable height in a room which was well lighted.

"The pubes and groin of the right side being shaved, an incision was commenced just above the external abdominal ring, and carried in a semicircular direction half an inch above Poupart's ligament, until it terminated a little beyond the anterior superior spinous process of the ilium, making in extent about five inches.

"The integuments and superficial fascia were now divided, which exposed the tendinous part of the external oblique muscle, upon cutting which in the whole course of the incision, the muscular fibers of the internal oblique were exposed; the fibers of which were cautiously raised with the forceps and cut from the upper edge of Poupart's ligament. This exposed the spermatic cord, the cellular covering of which was now raised with the forceps, and divided to an extent sufficient to admit the forefinger of the left hand to pass upon the cord into the internal abdominal ring. The finger serving now as a director, enabled me to divide the internal oblique and transversalis muscles to the extent of the external incision, while it protected the peritoneum. In the division of the last mentioned muscles outwardly, the circumflexa ilii artery was cut through, and it yielded for a few minutes a smart bleeding. This, with a smaller artery upon the surface of the internal oblique muscle, between the rings, and one in the integuments were all that required ligatures.

"With the tumor beating furiously underneath, I now attempted to raise the peritoneum from it, which we found difficult and dangerous, as it was adherent to it in every direction. By degrees we separated it with great caution from the aneurismal tumor, which now bulged up very much into the incision. But we soon found that the external incision did not enable us to arrive at more than half the extent of the tumor upwards. It was, therefore, extended upwards and backwards about half an inch within the ilium, to the distance of three inches, making a wound in all about eight inches in length.

"The separation of the peritoneum was now continued, until the fingers arrived at the upper part of the tumor, which was found to terminate at the going off of the internal iliac artery. The common iliac was next examined by passing the fingers upon the promontory of the sacrum, and to the touch appearing to be sound, we determined to place our ligature upon it about half way between the aneurism and the aorta, with a view to allow length of vessel enough on each side of it to be united by the adhesive process.

"The great current of blood through the aorta made it necessary to allow as much of the primitive iliac to remain between it and the ligature as possible, and the probable disease of the artery higher than the aneurism required that it should not be too low down. The depth of this wound, the size of the aneurism, and the pressure of the intestines downwards by the efforts to bear pain, made it almost impossible to see the vessel we wished to tie. By the aid of curved spatulas, such as I used in my operation upon the innominata, together with a thin, smooth piece of board, about three inches wide, prepared at the time, we succeeded in keeping up the peritoneal mass, and getting a distinct view of the arteria iliaca communis, on the side of the sacro-vertebral promontory. This required great effort on our part, and could only be continued for a few seconds. The difficulty was greatly augmented by the elevation of the aneurismal tumor, and the interception it gave to the admission of light.

"When we elevated the pelvis, the tumor obstructed our sight; when we depressed it, the crowding down of the intestines presented another difficulty.

"Introducing my right hand now behind the peritoneum, the artery was denuded with the nail of the forefinger, and the needle conveying the ligature was introduced from within outwards, guided by the forefinger of the left hand in order to avoid injuring the vein. The ligature was very readily passed underneath the artery, but considerable difficulty was experienced in hooking the eye of the needle, from the great depth of the wound and the impossibility of seeing it. The distance of the artery from the wound was the whole length of my aneurismal needle.

"After drawing the ligature under the artery, we succeeded, by the aid of our spatulas and board, in getting a fair view of it, and were satisfied that it was fairly under the primitive iliac, a little below the bifurcation of the aorta. It was now tied; the knots were readily conveyed up to the artery by the forefingers; all pulsation in the tumor instantly ceased. The ligature upon the artery was very little below a point opposite the umbilicus.

"The operation lasted rather less than one hour.

"In less than one hour from the operation, considerable reaction of the heart and arteries took place; he felt, as he stated, altogether relieved from the excruciating agony he had suffered since the aneurism commenced. The whole limb had now recovered its natural temperature.

"March 16. The day after the operation; pulse eighty; skin moist; limb warm as the other; complains of some pain at the ligature; ordered a purgative of neutral salts.

"March 17 and 18. There was considerable pain in the limb.

[1] Successful Ligation of the Common Iliac Artery. By Valentine Mott, M. D., Professor of Surgery, N. Y. Am. J. M. Sc., 1827, I, 156.

"April 8. There are no disagreeable appearances whatever. He appears to be doing remarkably well; has been bled once since the last report; takes a purgative every other day, and an opiate every night; pulse as in health; no pain; says he is entirely comfortable; wound dressed with dry lint.

"April 16. Has improved rapidly since the last report. Two days after the ligature came away he very imprudently got out of bed without experiencing any difficulty, except weakness. Rode out to-day; wound perfectly healed.

"April 30. Is perfectly restored to health; has a little stoop in his walk, which he says is occasioned by the external cicatrix. Leg is not yet of its full size, nor quite so strong as the other. From the period of the operation, to the recovery of our patient, he did not appear to suffer more pain, or to have more unpleasant symptoms, than would ordinarily take place in a flesh wound of equal extent.

"May 29. My patient visited me to-day, having come twenty-five miles; he was so much improved in health that I did not recognize him. Examined the cicatrix and found it perfectly sound; could not discover any remains of aneurismal tumor; *felt the epigastric artery much enlarged and beating strongly* (italics mine), and a feeble, though distinct pulsation in the femoral artery immediately below the crural arch. The leg has its natural temperature and feeling, and he says it is as strong as the other.

"The gratification his visit afforded me is not to be imagined, save by those who have been placed under similar circumstances. The perfect success of so important and novel an operation, with the entire restoration of the patient's health, was a rich reward for the anxiety I experienced in the case, and in a measure compensated for the unexpected failure of my operation on the arteria innominata.

"New York, 25 Park Place, October 15, 1827."

It is interesting to note that Dr. Mott raised the pelvis, just as we do to-day, with the object of having the abdominal contents gravitate towards the thorax. Being without artificial illumination or means of reflecting the day-light into the wound, he had to abandon this useful, and for us to-day, quite indispensable measure because with the pelvis elevated, the aneurismal tumor obstructed the view.

In 1853, Prof. Uhde, of Braunschweig, tabulated 17 cases of ligation of the common iliac artery performed to the year 1850 and reported in full detail a case in which he tied this vessel for aneurism of the gluteal artery. The article is illustrated with interesting wood-cuts depicting the conditions found by him at the autopsy of his patient. Uhde tabulated also, in this paper, the ligations, to 1852, of various arteries for the cure of gluteal anuerism.

Of the statistical papers on the subject of ligation of the common iliac artery the classic one of Stephen Smith,[1] published in 1860, is especially important.

It is a tale of woe that Dr. Smith had to relate, tragic for the patient and for the surgeon; but hardly more pitiful than is to be found in the history of the operation as it has been performed in our modern antiseptic and aseptic times.

Stephen Smith collected 31 cases of ligation of the common iliac artery and reported an additional case of his own. In the 32 years from 1829 to 1859, 32[2] ligations of this artery were made and this average of one a year has been approximately maintained to the present time.

In the following table Dr. Smith has arranged the cases in chronological order (l. c., p. 19).

No.	Date of Operation.	Operator.	Result.
1	July 27, 1812	Gibson, of Philadelphia	Died
2	March 15, 1827	Mott, of New York	Cured
3	July 18, 1828	Crampton, of Dublin	Died
4	December 1, 1829	Liston, of Edinburgh	Died
5	August 24, 1833	Guthrie, of London	Cured
6	April 1836	Stevens, of New York	Died
7	May 26, 1837	Salomon, of St. Petersburg	Cured
8	1837	Garviso, of Monte Video	Died
9	June 8, 1838	Syme, of Edinburgh	Died
10	November 29, 1838	Pirogoff, of Dorpat	Died
11	April 10, 1839	Bushe, of New York	Died
12	February 22, 1840	Deguise, of Paris	Cured
13	August 26, 1840	Post, of New York	Died
14	August 29, 1842	Peace, of Philadelphia	Cured
15	December 3, 1843	Hey, of York	Cured
16	1843	Garviso, of Monte Video	Cured
17	January 27, 1845	Stanley, of London	Died
18	June 3, 1847	Lyon, of Glasgow	Died
19	September 19, 1850	Chassaignac, of Paris	Died
20	December 29, 1851	Jones, of Liverpool	Died
21	January 1852	Moore, of London	Died
22	March 27, 1852	Wedderburn, of New Orleans	Died
23	October 7, 1852	Uhde, of Braunschweig	Died
24	November 1853	Van Buren, of New York	Died
25	March 20, 1857	Edwards, of Edinburgh	Died
26	March 26, 1857	Holt, of Georgia	Died
27	July 15, 1857	Meier, of New York	Died
28	July 3, 1858	Parker, of New York	Died
29	July 6, 1858	Buck, of New York	Died
30	October 6, 1858	Stephen Smith, of New York	Died
31	January 26, 1859	Stone, of New Orleans	Died
32		Goldsmith, Louisville	Died

"The indications," Dr. Smith writes, "which have thus far led to the deligation of the primitive iliac artery may be divided as follows:

"I. For the arrest of hemorrhage.

"II. For the cure of aneurism.

"III. For the cure of pulsating tumors, which proved to be malignant growths.

"IV. For the prevention of hemorrhage in the removal of a morbid growth."

In Group I are eleven cases. Ten of these died; nine from hemorrhage, primary (five), or secondary (four); one from peritonitis. Dr. Smith contrasts the mortality from ligation of the primitive iliac artery for the arrest of hemorrhage (approximately 91%) with that following the same operation performed 14 times upon the external iliac artery for the same causes (21½%) and makes this comment "a proper appreciation of the circumstances under which the primitive iliac artery has been tied for the arrest of hemorrhage will lead the discriminating surgeon, notwithstanding the excessive mortality that

[1] A Statistical Examination of the Operation of Deligation of the Primitive Iliac Artery, embracing the Histories (in abstract) of Thirty-two Cases. By Stephen Smith, M. D., Surgeon to Bellevue Hospital, New York. Am. J. M. Sc., 1860, n. s. XL, 18.

[2] The date of the 32d operation by Middleton Goldsmith was not obtainable, but as Prof. Goldsmith reported it in February, 1860 (Louisville Medical Journal), the operation was presumably performed in 1859, or earlier.

has thus far attended its performance, to accord to this operation an important place among the resources of his art."

In Group II (for the cure of aneurism) there are 15 cases. Five of these recovered; ten died; in two the result was unknown. This group has the greatest percentage of recovery from the operation and it is noteworthy that in at least one, Peace's, of the non-fatal cases, ligation of the common iliac artery did not suffice to cure permanently the aneurism which returned about 14 months later, ruptured and caused the death of the patient. In one of the recovered cases, Salomon's, gangrene ensued as result of the ligation. In this instance, a gangrenous eschar formed on the foot on the third day after operation, and "subsequently others appeared," but "convalescence was complete at the end of two months." This patient died ten months after the operation from an abscess below Poupart's ligament on the operated side.

Gangrene was the cause of death in two of the fatal cases, but in one of these, Syme's, it was present before operation.

Dr. Smith makes the following comment in considering the results of the operation of deligation of the common iliac artery for aneurism, as compared with the same operation upon the external iliac:

> In ninety-five cases, which I have examined, of ligation of the latter (external iliac) artery for aneurism, sixty-nine recovered and twenty-six died, being a mortality of about 27 per cent, or less than half the mortality of the same operation for the same disease when performed upon the common trunk. The cause of death in eleven cases, or nearly one half, of ligation of the external iliac for aneurism was mortification of the limb, presenting a striking contrast with the same operation upon the primitive iliac in which there was but one instance in eight cases.

Group III. *Deligation of the common iliac for malignant tumors simulating aneurism.* It is noteworthy that in all four of the cases in this group the pulsating neoplasm was mistaken for aneurism. Mr. Astley Cooper who saw, in consultation, Mr. Guthrie's case expressed himself as positive that it was an aneurism.

In Group IV are two unclassified cases. The second of these, Chassaignac's, was, as Dr. Smith says, one of the most remarkable of the series. This eminent surgeon operated in a most brilliant manner for the cure of a large encephaloid tumor of the internal and superior aspect of the thigh, extending to the foramen ovale, and after ligation of the common iliac artery, the tumor was removed, "with scarcely the appearance of blood." The entire operation, performed under chloroform, lasted only half an hour.

Surgeons of the present day would be entertained by the perusal of the comments which Chassaignac's report of the case called forth, at a meeting of the *Société de Chirurgie.*[7] Dr. Smith gives an abstract of the discussion. Larrey, Robert and Forget condemned the operation in unqualified terms, Larrey blaming the operator for attempting so considerable an operation without previous consultation with his colleagues. Gosselin and Maisonneuve sustained Chassaignac.

In the 32 cases the extraperitoneal incision was employed by all the operators with the exception of Gibson, Garviso, Post and Goldsmith. Of the nine cases in which the peritoneal cavity was opened, either accidentally or intentionally, only two acquired peritonitis, and in both of these hemorrhage was an associated cause of death.

Another paper of importance on the subject of ligation of the common iliac artery and almost equal in statistical value to Stephen Smith's, is by Kümmel,[8] assistant at that time (1884) of Prof. Schede in the Allegemeines Krankenhaus zu Hamburg, and at present Surgical Director of the Eppendorf Hospital, Hamburg, which is so well known to surgeons throughout the world. To the thirty-two cases of Stephen Smith, Kümmel adds thirty, collected from the twenty-four years between 1860 and 1884, an average of one-quarter of a case per year in excess of the record of the first 32 years in the history of the ligation of this artery.

With one or two exceptions, the complications which have led to the performance of this operation have been of grave import. In Groups III[9] and IV[10] of Stephen Smith they are obviously of such nature as to make the cases comprised in these groups useless for the purpose of this study.

We shall consider, therefore, only cases which have been operated upon for the control of hemorrhage (Group I), or the cure of aneurism (Group II).

ABSTRACTS OF CASES FROM 1880 TO 1912.

1. (Group I.) O'Grady, E. S. *Ligation of the left common and internal iliac arteries to arrest hemorrhage in a case of varicose aneurism for the cure of which the femoral artery had been ligated nine months previously. Death in about seven hours.* (The Medical Press and Circular, Dublin, 1880, July 28, p. 71.)

Male, æt. 28. At the age of 13, patient clapped his thighs together to catch a shoemaker's knife. The sharp knife "transfixed the long saphenous vein and penetrated the femoral artery." Since the accident he had required surgical assistance at various times. With the aid of rest and the habitual use of an elastic bandage he had managed to earn a living. A pulsating tumor had formed "in the anterior and inner region of the middle of the left thigh." When examined by Mr. O'Grady (presumably in November, 1879), this tumor was as large as a cocoanut, and very prominent. From its lower part, there projected two hemispherical nodules as large as walnuts. The tissue intervening between these and the pulsating finger was so thin that it seemed as if the pulsating tumor might burst at any moment. Pressure on the femoral artery above stopped the pulsation. The long saphenous vein, dilated to the size of a man's thumb, "traversed and was imbedded in the mass." "There were enormously large knots of dilated and tortuous veins behind the knee and down the leg." A bruit was distinctly audible to bystanders and could be loudly heard over the heart.

Operation.—(Nov. ? 1879.) Two days after admission to the Mercer's Hospital, Dublin, the superficial femoral, cut down upon, was found to be as large as "a large man's middle finger"; its coats were "thin and unhealthy looking." The vessel was ligated with carbolized catgut in two places and cut between, the upper ligature being about one inch below the origin of the profunda

[7] Bull. Soc. de chir. de Par. Paris, 1851.

[8] Kümmel, Arch. f. klin. Chir., 1884, XXX, 65.

[9] Group III. Ligations of the common iliac for the cure of pulsating, malignant growths.

[10] Group IV. For the prevention of hemorrhage in the removal of a morbid growth.

artery. Each of the divided ends was again tied with a ligature of the same material. The wound was loosely closed with two interrupted sutures and covered with lint moistened in carbolized oil. The limb was wrapped in flannel bandages and surrounded by hot jars. Three hours after the operation the foot and leg were found to be very cold. The following morning they became warmer. The tumor was quite solid. Three days later the wound and parts about it were considerably inflamed, but there was no return of the pulsation or thrill. The latter lessened in intensity, "soon" returned, however, in the long saphenous vein which "stood out large and distended." Attempts, continued for some weeks, to bring about obliteration of this vein by pressure with padded corks proved ineffectual.

"Sixty-six days after the deligation an aqueous solution of perchloride of iron was injected into a carefully insulated portion of the saphenous vein, the region selected being the central two inches where it crossed the tumor." Ten days later the same procedure was repeated without the desired result. But a week later a like injection, made lower down into the vein, was followed by a satisfactory local reaction, which in two days had sprung up and down the vein and "thoroughly coagulated its contents for its entire length."

One hundred and forty-eight days after the operation the patient left the hospital, his departure having been delayed by "recurrent attacks of more or less severe inflammation of the glands of the groin." The vein remained obliterated, and the aneurism was slowly getting smaller. July 5, nine months after the deligation of the femoral artery, the patient returned to the hospital because there had been slight bleeding from the cicatrix. He reported that there had been occasional attacks of inflammation in the groin, and that from a particular spot in the cicatrix there would be discharged, every now and then, a drop or two of thin matter.

Examination.—The right groin and the abdomen to the ribs were swollen and tender and reddened with an erysipelatous blush. There was pulsation in "the stump of the femoral," but the swollen condition of the parts precluded the possibility of recognizing with certainty "how far any fresh aneurism formation might be present."

"On the night of the 8th, it could be determined that an aneurism had formed on the stump of the femoral, and was rapidly increasing in size."

July 9. At 7.45 a. m., "a terrible gush of arterial hemorrhage occurred," which, "though arrested 'on the moment,' left the patient blanched and prostrate."

Two hours later, the patient having rallied a little, the external iliac artery was cut down upon through matted tissues and adherent glands, but the vessel, found to be enormously enlarged, could not be isolated. So the incision was prolonged to the tip of the twelfth rib. The external iliac artery was followed up. It was tortuous and "as big as a sausage," "resembling a coil of intestine." The internal iliac, "atrophied rather than enlarged," was ligated with catgut and the common iliac artery as well.

The patient rallied and complained of great pain along the front of the tibia.

Seven hours later, becoming suddenly pulseless, he died.

Under difficult conditions a local examination was effected. There had been no further bleeding, and nothing was found to account for the sudden demise. "*The external iliac much exceeded the abdominal aorta in size;* it was a marvel how such a river of blood was controlled promptly enough to prevent immediate death." The long saphenous vein was atrophied and impervious.

2. (Group II.) Richter, C. M. *Ligation of the right common iliac for huge aneurism of the external iliac artery. Gangrene before operation.* (Max Richter, Pacific Medical and Surgical Journal, 1880-1881, p. 505.)

Male, æt. 30. Admitted to the German Hospital, San Francisco (?) Jan. (?) 1881. "Rheumatic" pain in right inguinal region six and one-half months before admission.

Examination.—An irregular tumor the size of a child's head occupied the right hypogastrium. Pulsation not discernible. On auscultation a remote bruit could be heard. Arterial blood was aspirated with a hypodermic syringe. The right leg was œdematous, and its circumference about twice that of the other. Sensibility normal. Motility unimpaired. Patient was very anemic, suffered from dyspepsia and constipation and from severe pains in the right leg and sacral region, which recurred every morning. The proposition to ligate the common iliac was not acceded to by the patient for several weeks. The tumor meanwhile increased in size, the pains became more severe, and finally intolerable and uncontrollable by morphia. Power of motion in the leg became lost and signs of gangrene appeared. Finally the patient consented to the operation.

Feb. 19. The right common iliac was ligated by Dr. C M. Richter. On account of the enormous size of the aneurism and the œdema in the tissues about it, the incision was made on the left side, parallel to Poupart's ligament, and the artery exposed extraperitoneally. The artery was tied with a silk ligature about one-half inch from its origin. The aneursim collapsed, but the gangrene, in two days, had extended to the knee. The limb was anesthetic as high as Poupart's ligament. Nowhere in the extremity could arterial pulsation be felt. Three days after ligation, amputation of the thigh was made. The operation was performed according to the antiseptic method of Lister. An Esmarch bandage was applied just below Poupart's ligament, and the amputation performed in a manner quite bloodless. The large arteries were filled with recently coagulated blood. On removal of the Esmarch bandage, vessels bled from all parts of the stump, and twenty or thirty blood-vessels were ligated.

On the ninth day the surface of the stump appeared to be gangrenous. Chloride of zinc was applied, seemingly with good effect. On the thirteenth day afterwards, there was a rise in temperature, but the wound was granulating satisfactorily. Pus was discharged from the abdominal wound on the fifteenth day.

On the thirty-third day after operation, the patient was doing well. The ligature had not yet come away, but ultimate recovery seemed assured.

3. (Group II.) Nicoladoni. *Ligature of the right common iliac artery for spurious aneurism of the right hypogastric region. Death forty-five hours after operation.* (August Sulzenbacher. Wiener medicinische Presse, 1882, Nos. 7, 8, and 9.)

Male, æt. 31. Admitted to the Innsbruck Hospital, Nov. 11, 1881. Four weeks before admission was wounded in the right groin with a knife. Profuse bleeding from the wound was controlled by pressure of the patient's hand until his strength failed; then, with both hands, he pressed the flexed thigh on the body in order to arrest the hemorrhage. In this position the patient was carried to the Bozener Stadtshospital. On arrival, the bleeding had ceased. A wound in the middle of the right inguinal fold, promptly closed with stitches, healed with the formation of a small abscess. Thirteen days later, apparently recovered, he left the hospital, but soon applied for admission, because a tumor had developed in the right hypogastrium, which from day to day increased in size.

Examination (on admission to Prof. Nicoladoni's clinic).—Skin and mucous membrane pale, voice weak and motions strengthless. The right lower extremity, swollen, bent at knee, and hip rotated outwards. The swelling was greatest at junction of thigh and trunk, where the skin was tense and glistening, and the ramifications of the veins dilated. A pulse in the femoral artery could be felt, but it was barely perceptible in the posterior tibial. The entire right hypogastrium was conspicuously vaulted by a hard, and, in places, nodular tumor which extended from the anterior

superior spine to beyond the middle line, and from two inches below the navel into the pelvis behind the symphysis. On palpation, a peculiar vibrating thrill and slight heaving synchronous with the heart's systole could be appreciated. From the rectum a hard tumefaction was felt on the right side.

Diagnosis.—"Aneurysma Spurium; masses of coagulated blood in the pelvis; wound of epigastric artery, probable; of external iliac artery, or of both these vessels, possible." It was emphasized that the femoral artery pulsated peripherally to the seat of the injury.

Operation.—Nicoladoni. Nov. 15, 1881. Long, mid-line incision to give ready access to the large arteries in case of necessity. Then a long incision parallel to Poupart's and, finally, through this ligament in search for the epigastric artery, and to expose the femoral vessels.

On the accidental opening of the sac, a profuse spurting hemorrhage occurred. After a vain attempt to isolate the pulsating external iliac from the wall of the aneurism, the peritoneal cavity was entered and the common iliac artery ligated with iodoformized silk. Thus the pulsation and bleeding were completely arrested. Intestines which had been eventrated to facilitate the operation were replaced and the abdominal wound sutured. Then the femoral artery was ligated peripherally, and the aneurismal sac laid open. In a small cavity, the size of a hen's egg, a hole in the upper side of the femoral (?) artery was found; a second larger cavity led into a wide subperitoneal space. Arterial hemorrhage "from the peripheral end of the external iliac" (?) was controlled by the central ligation of this vessel. Great masses of blood coagula, black and rusty brown in color, were removed from the spurious sac, which extending into the small pelvis and filling the iliac fossa, had dissected down the thigh under the fascia lata and between the muscles. Wound closed, drained and covered with antiseptic dressing. Duration of operation, with deep narcosis, three and one-half hours.

The following day, Nov. 16, pain in leg and, later, in abdomen. Great thirst and restlessness. Pulse 144, temperature 102.

Nov. 17. Death at 10 a. m., forty-five hours after operation.

Autopsy.—Ligature on common iliac, 2.5 cm. below aortic division. Above this point, a soft clot in the artery. Right internal iliac artery decidedly larger than the left. The crural artery together with the epigastric ligated at Poupart's ligament. In the anterior abdominal wall, the epigastric artery had been cut through not far from its origin. The femoral vein was dilated and filled with a tough and adherent thrombus, on removal of which there was found in the posterior wall of the vessel a sharp-edged slit. The femoral artery, united with dense connective tissue to the vein, was found to be again ligated below Poupart's ligament. The stabbing knife had, therefore, cut across the epigastric artery near its origin and into the femoral artery and vein, thus confirming one of the possibilities formulated in making the diagnosis. No reference is made to the condition of the circulation in the foot.

4. (Group II.) Lange, F. *Ligation of the left common iliac artery for ileo femoral aneurism. Cutaneous gangrene of great toe. Cure of aneurism.* (New York Medical Journal, 1883, p. 610.)

Patient, male, æt. 36. Denied syphilis, but had had leutic manifestations. In July, 1882, the patient experienced pain about the left knee, which appeared quite suddenly and caused pronounced lameness for a time. He noticed also a lump about the size of a pigeon's egg in the left groin. Never entirely free from soreness in the knee joint, he suffered at times intensely until January, 1883. The patient was seen by Dr. Lange for the first time in July, 1883. At that time, "a pulsating tumor with all the characteristics of an aneurism occupied almost the whole of the left iliac fossa, causing the abdominal wall to protrude above Poupart's ligament. Its upper boundary ran from the anterior spinous process toward the umbilicus, ending about an inch below the latter in the middle line which formed its mesial outline. A spindle-shaped process of the tumor extended in the direction of the femoral artery below Poupart's ligament. But nowhere could arterial pulsation be detected in the limb, which was cool and had a bluish hue."

Operation.—July 26. Intraperitoneal ligation of the common iliac artery. Silk ligature, ends cut short. "No bad symptoms followed the operation, and the vitality of the limb remained unimpaired, excepting a small cutaneous necrosis of the great toe."

Three months later the temperature of the affected limb had become more nearly normal, but it was paler in color than the other, and was less well nourished. Its sensibility was normal, but its reflex irritability was diminished. The pain had ceased and the tumor had shrunk to the size of an orange. The coolness, numbness and blueness of the leg before operation presaged insufficient collateral circulation.

5. (Group I.) Kümmel, H. *Ligation of the left common iliac, of the external iliac (twice), of the femoral (three times), and probably of the epigastric and circumflex iliac arteries, without gangrene. After, however, the ligation of three similar arteries (presumably profunda, internal circumflex and external circumflex), gangrene supervened. Recovery.* (Verhand. d. Deutsch. Gesellsch. f. Chir., 1883, and Archiv f. klin. Chirurgie, 1884, XXX, 67.)

Male, aet. 21. Following operation, by an unnamed surgeon, for bubo inguinalis on both sides, there occurred a diphtheritic inflammation of the wound of the left groin.

Nov. 26, 1883. (?), four days after the operation, a profuse hemorrhage took place from the eroded left femoral artery. The bleeding was arrested promptly by digital compression and artery clamps. Dr. Schede placed two ligatures of silk on the femoral artery immediately under Poupart's ligament, and divided the vessel between them. He also "tied off certain vessels opening into the artery above the ligatures." (Epigastric and circumflex iliac ?). It was found that perforation of the femoral artery had occurred in two places. The circulation of the leg was completely restored by evening of the day of operation. The energetic use of concentrated solutions of corrosive sublimate arrested the diphtheritic process in the wound, but caused salivation and bloody stools. The symptoms of mercurial poisoning subsided in a few days under appropriate treatment.

Nov. 30. Severe hemorrhage from the central end of the femoral artery. Although the bleeding was promptly checked with digital compression by an orderly, and then by artery clamps applied by Dr. Kümmel, the loss of blood was badly tolerated by the already greatly reduced patient.

Having transported the patient to the operating room, Dr. Kümmel ligated with catgut, extraperitoneally, the external iliac artery, believing it wiser to operate at some distance from the infected wound, and having found it impossible to make the ligation in loco. On removing the artery forceps, which had been applied to check the hemorrhage from the femoral artery, there spurted forth a stream as powerful as before. Attempts to ligate the femoral (central end) proving again futile, the external iliac was tied once more, just below its origin from the primitive iliac, but without the least influence upon the bleeding. Hence the common iliac was ligated (with catgut, extraperitoneally) about 3 cm. above its bifurcation. Thereupon the bleeding ceased completely. Throughout the operation the wound was almost continuously irrigated with a solution of bichloride of mercury (1-1000), and occasionally flushed with basins full of the same solution. Sev-

eral thick, glass[11] drains were carried down to the site of the ligature on the common iliac; the wound was stitched and dressed with glass-wool and sublimate gauze.

The patient was in the highest degree exhausted by the operation. Puse 120 and thread-like. The left lower extremity quite cold. On the following morning, however, the circulation of the limb was completely restored. Thus *ligation of the common iliac after double ligation of the femoral, double ligation of the external iliac, and ligation, supposedly, of the circumflex iliac and epigastric vessels had not apparently impaired the circulation of the limb, notwithstanding the greatly exsanguinated and exhausted condition of the patient.*

Needle pricks were well perceived and accurately located. Motility was unimpaired. Severe pains in the limb were ameliorated by injection of morphine.

The second day after operation (Dec. 2) the condition of patient and wound were relatively excellent. Pulse 96. The circulation, sensibility and motility of the limb normal. The pains had become much less.

Dec. 10. Ten days after the ligation of the common iliac, there came a sudden hemorrhage from the original "ligature wound" of the femoral. Although the bleeding was promptly controlled by compression of the abdominal aorta and of the bleeding point, the loss of blood was great and the patient utterly exhausted. On closer investigation, it was found that the hemorrhage came from the peripheral end of the femoral. With difficulty isolated from the disintegrated tissues, this was tied off 2 cm. below its divided end. But the bleeding remained unchecked. It came from "three thin-walled arteries about the size of a pen-quill, which ran backwards, inwards and outwards." Were these, perhaps, the profunda, internal and external circumflex arteries?

The following day (December 11) a livid discoloration of the foot was observed. Temperature 105° F. Pulse 144, dry tongue, delirium.

Dec. 12. Pulse 156. Increase of delirium. Livid discoloration to the middle of the leg. Condition of patient so bad as to contraindicate operation.

Dec. 13. The gangrene seemed demarked between the upper and middle thirds of the leg. Pulse 128. A transcondyloid amputation was made as expeditiously as possible, and then a reablation at a higher point on account of the impaired circulation in the flaps. Blood flowed from the femoral artery and vein, and also from muscular vessels. Gradually, the patient developed the picture of a chronic pyæmia. Abscesses appeared on the nates and left arm. Decubitus developed over the sacrum, and in the articulations of the lower jaw and knee. Ultimately, the patient was put in the permanent bath, in which the wound took on a healthy appearance and showed a tendency to heal. From this time the prolonged convalescence was uninterrupted.

March 3. Patient was able to leave his bed.

This case and Clark's (26) are the only ones in the antiseptic period which have recovered after ligation of the common iliac for the control of severe hemorrhage. In the whole literature of the subject there is perhaps no case more thrilling. In our collection of thirty cases of the antiseptic period only eight belong to Group I. Of these, four died, and one (Kümmel's) narrowly escaped death. Of the remaining three, Czerny's belongs only technically to Group I, for the ligation of the common iliac was made in the course of an operation for the removal of tuberculous glands to control slight bleeding from some artery torn off close to its parent trunk in the course of the dissection.

[11] Dr. Kümmel, it will be recalled, was the originator of the *Inorganischer Verband.*

In Meyer's case, very briefly reported, it is not stated that the hemorrhage was severe.

The hemorrhage in Clark's case, however, was to the point of collapse.

6. (Group II.) Schönborn, Karl. *Ligation of the right common iliac for aneurism of the internal and external iliac arteries. Recovery. Cure of the aneurism.* (Stetter. Zentralblatt f. Chirurgie, 1884, p. 160.)

Male, æt. 75. Difficulty in walking beginning in January, 1882, gradually increased until, in October of the same year, patient was unable to step on his right foot. About this time, there was noticed in the region of the right groin a tumefaction which rapidly increased in size, and was at first considered to be an abscess having origin in a bone of the pelvis.

In January, 1883, an aspirating needle was introduced through which "neither blood nor pus" escaped. As the swelling increased, it manifested itself in the gluteal region. At last the pain became so great that there was no relief night or day, except with the use of chloral or morphine.

Examination.—Patient seemed robust for his years, and his general condition was good. He could bear no weight on his right foot, nor walk at all without firm support. Heart and palpable arteries were apparently normal. In the right iliac fossa a strong pulsation could be felt. On careful inspection a slight swelling was observed in the right supratrochanteric region which, fading off towards the right groin, extended behind and below the lower edge of the gluteal musculature. Above, it approached the crest of the ilium, and inwards the pubic symphysis. Throughout its entire extent, rhythmic pulsation could be seen and felt. On auscultation a systolic bruit isochronic with the pulse was heard. In the posterior tibial artery a distinct pulse could be felt. Examination by rectum revealed nothing anomalous.

Diagnosis.—Aneurism in the neighborhood of the common iliac, quite surely of a large vessel, probably of the internal and also of the external iliac. Ligation of the common iliac artery was determined upon as nothing less formidable could be done with any prospect of success.

Operation.—May 2, 1883. Prof. Schönborn. Thymol spray. An incision, 34 cm. long, concave upwards, was made from the inner third of Poupart's ligament to the lower border of the twelfth rib. The artery, exposed in the extraperitoneal manner, had an astonishingly transverse course, and was acutely bent on itself. Its wall seemed softened. A catgut ligature was applied. It developed, on further examination, that the aneurism had its origin in the right hypogastric (internal iliac), and extended over into the external iliac artery. Both vessels gave evidence everywhere of atheromatous changes. At the moment of tying the ligature the rate of the pulse was increased from 60 to 75, and in three minutes, to 80 beats.[12] There was complete arrest of pulsation in the arteries peripheral to the ligature. The ends of the ligature were cut short, drains carried to the artery and elsewhere, the wound was sutured and covered with a Lister dressing. Notwithstanding the precautions, the wound broke down and suppurated everywhere, except at the ends and about the ligature. Necrosis of the fascia and skin necessitated numerous incisions and drainage.

The ligation exerted no manifest influence upon the limb except the blocking of the pulse. The temperature of the skin of the foot, which seemed slightly less than on the opposite side for ten days, remained normal thereafter.

Pains in the extremity were severe at first, but gradually dis-

[12] Compare with observation in Fluhrer's case in which the heart's action was slowed.

appeared altogether. The healing of the wound was slow, accompanied by fever and the separation of necrotic masses.

Aug. 2. Three months after the operation, the wound was healed and the patient discharged. The aneurismal swelling had become considerably smaller. Pulsation neither in it nor in the posterior tibial was to be felt.

Nov. 1883. Six months after the operation patient stated in a letter that he was quite well, and able to walk with a cane.

7. (Group I.) Kümmel, H. *Aneurism of the right inguinal region and the calf. Ligation of the external iliac. Secondary hemorrhage. Ligation of the right common iliac. Death in twelve hours.* (l. c., p. 103.)

Female, æt. 21. Admitted to the medical division of the hospital for articular rheumatism and peliosis rheumatica. Developed aortic stenosis and insufficiency. In the further course of the disease a pulsating tumor, the size of a walnut, and causing great pain, appeared in the right groin in the region of the anterior crural nerve; a short time thereafter, a diffuse, tense, pulsating swelling in the muscle of the calf was observed. For both the diagnosis of aneurism was made.

The condition of the patient was so bad that an operative procedure was not contemplable, especially as the multiplicity of the aneurisms indicated general arterial disease.

The patient's strength continuously failing, there occurred a rupture of the aneurism in the calf followed quickly by extensive gangrene of the soft parts of the leg.

Dec. 5, 1883. The skin and the disintegrated tissues underlying it gave way and, thereupon, there followed a severe hemorrhage. Although this was controlled by a promptly applied Esmarch bandage, the already exhausted patient became almost pulseless as she was brought to the operating table.

As it was impossible to check, in loco, the bleeding, there remained only the alternatives of amputation above the knee or ligation of the main arterial stem. Amputation seemed too serious a procedure. Furthermore, it was feared that rupture of the aneurism in the groin might be brought about by ligation of the femoral artery below it. Hence the external iliac was ligated above the upper aneurism in order to cut the circulation off from this as well as from the ruptured tissues in the calf. Pulsation in the groin ceased, and the aneurismal sac collapsed completely. On removal of the Esmarch bandage, there was no return of the bleeding in the leg. Masses of clots and necrotic tissue were removed from the calf, and the great hole cleaned out and stuffed with sublimate-gauze. In two hours, there was sudden profuse bleeding from the calf and, coincident with this, a tense refilling of the aneurism above, and reappearance of its pulsation.

Again, and in worse condition than ever, the patient was placed on the operating table. The common iliac was ligated extraperitoneally, with catgut, about 3 cm. below the aortic bifurcation. The operation was performed in 15 minutes and without anesthetic. Infusion of 800 cc. of salt solution. Death in 12 hours.

Autopsy.—Aneurism of a branch of the profunda. The posterior tibial artery emptied into the gangrenous cavity of the musculature of the calf. A small aneurism of the right posterior cerebral artery. Insufficiency and stenosis of the aortic valves, and in lesser degree of the mitral.

This case has no bearing on either the mortality or the occurrence of gangrene after ligation of the common iliac. Hemorrhage, unpreventable in an already exhausted patient, was the immediate cause of death.

8. (Group I.) Gouley, John W. S. *Ligation of the right common iliac for diffuse aneurism of the external iliac artery. Death from pyæmia on the twenty-first day. Beginning gangrene.* (New York Med. Jour., 1885, Feb. 28, p. 239.)

Male, æt. 22. Admitted to Bellevue Hospital, New York, Oct. 8, 1871, for a painful pulsating tumor of the right inguinal and iliac regions.

History.—About two years before admission a heavy barrel rolling against him inflicted a contusion in the neighborhood of the right groin. Soon after this injury he contracted urethritis and a chancre. These were followed by an enlargement of an inguinal gland which subsided without suppuration. No constitutional symptoms ensued so far as could be ascertained.

Nine months before entering the hospital he had noticed a tumor just above Poupart's ligament on the right side. Three months later he observed for the first time that it pulsated. It was then about as large as a hen's egg. The man continued to work at heavy labor, although the tumor was rapidly increasing in size and gave him great pain, of a burning character, and chiefly in the course of the anterior crural nerve.

Examination.—There was a large, pulsating, elastic tumor which extended six inches above and two inches below Poupart's ligament, and to within two and one-half inches of the median line. Over it a bellows murmur was distinctly heard. The integument overlying the swelling was dark colored and œdematous. It was thought that slight pulsation could be felt in the right anterior tibial, but not in the femoral or posterior tibial arteries.

Operation.—Oct. 12, 1871. A curvilinear incision, nine inches long, beginning above at the tenth rib, was carried through all the structures of the abdominal wall except the peritoneum. This was reflected upwards, and the spatula which had been used as retractor by Valentine Mott in the performance of the same operation was on this occasion held by Dr. A. B. Mott, his son, who assisted Dr. Gouley. The Mott artery-needle was also employed to carry the stout silk ligature with which the common iliac was tied. Pulsation in the tumor immediately ceased. The operation required only thirty-two minutes.

Oct. 13. The tumor had softened and the pain vanished. The temperature of the limb on the operated side was found to be higher than on the other.

Oct. 14. During the night the patient had a sudden attack of diarrhœa. This was checked by morphia.

Oct. 16. Pulse 112; temperature 102.7° F.

Oct. 17. "The tumor began to show signs of rupture"; its wall at the lower portion had become extremely thin and the overlying integument gangrenous.

Oct. 22. "Dark tarry blood began to ooze from the sac through a small opening, and the sac was floating, as it were, in a pool of pus."

Oct. 26. Pulse 120; temperature 102° F. Dr. Gouley "cut short the slow spontaneous enucleating process by introducing a finger and sweeping around that part of the sac which was out of sight, and at the same time removed portions of sloughy muscular tissue." After the sac had come away he could "with the finger still in the cavity, feel the bladder."

April 27 and 28. Chills and bed-sore. Placed on water-bed. Pulse 140; temperature 103° F.

Oct. 29. Patient complained of intense pain in the heel and foot of the affected side. Sensation was absent in these parts, and their surface was cold.

Oct. 31. Ecchymosis observed about the right ankle. The pain had extended up into the leg and was very intense. Chills.

Nov. 1. "The ecchymosis had greatly increased."

Nov. 2. Death.

Autopsy.—"The ligature lay loose in the wound. The primitive iliac artery was completely obliterated. Nearly the whole of the external iliac had sloughed away with the sac, leaving less than an inch of its lower extremity, which was entirely closed. There was a pelvic abscess which involved the psoas muscle. The femoral and iliac veins were free from thrombus."

Epicrisis.—Dr. Gouley made the following wise comment: "It seems to me that if I had carried out my intention of freely opening the sac, the chances of recovery would have been greatly increased, and that this procedure for which we had such strong warrant, and which in itself is so simple, so philosophical, and therefore so eminently surgical, should be more insisted upon than it has been of late years." The patient "succumbed from pyæmia solely because a great bag of dead decomposing blood was retained in his flank. If after ligature of the main artery the sac had been freely opened and the clots extracted, and the cavity filled with lint, I am sure that the risk of this expedient would have been infinitely small as compared with the expectant plan which was so unfortunately adopted."

The signs of gangrene (ecchymoses) which developed just before death were due, of course, in part to the enfeebled action of the heart, and probably also to the blocking of important anastomotic arteries communicating with and in the immediate neighborhood of the necrotic sac.

9. (Group II.) **Jameson, L. S.** *Ligation of the right common iliac for aneurism of the external iliac artery. Recovery. Cure of aneurism.* (Lancet, Lond., 1886. March 6, p. 444.)

Female, æt. 28. Admitted to Kimberly Hospital, Cape Colony, April 20, 1885.

Eleven months before admission she noticed a small swelling the size of a nut in the right groin. This gradually enlarged during the following six months, without causing pain, to the size of an apple. Then, the tumor enlarging rapidly and becoming softer, she noticed a "beating" sensation in the swelling, and pain and numbness down the leg.

Examination.—Above Poupart's ligament was an oval pulsating swelling as large as the head of a new-born child, which extended outwards to within an inch of the anterior superior spine, inwards to the mid-line and upwards to the umbilicus. The upper portion of the tumor was solid; below it was soft; the skin of a deep purple color, looked as if it might rupture on the slightest provocation. There was marked swelling of the whole of the right limb. Pulsation in the posterior tibial artery was "practically" imperceptible.

Operation.—April 21. The tumor was so large that it was deemed impossible to expose the right common iliac by operating on the right side. The incision, consequently, was made on the left side; the left common iliac was located extraperitoneally and traced up to the bifurcation of the aorta. The right common iliac, well overlapped by the aneurism which apparently had its origin in the external iliac, was ligated with stout carbolized silk. Pulsation in the aneurism ceased at once.

The following day, April 22. Slight pain and restlessness. Temperature a. m. 101° F.; p. m. 101.6° F. The wound showed increased discoloration at its lower part.

April 23. Discharge of bloody serum from wound. No pain. No abdominal distension.

April 28. Temperature 99° F. No pain. Superficial and deep stitches removed. Some gaping of the superficial wound.

April 29. Pain in the leg. Temperature normal.

May 12. Bed sore over sacrum, which was present on admission. Patient remained in the hospital for three months longer, the tumor diminishing slowly in size.

Oct. 15. On deep pressure the tumor, quite solid, measured 2½ x 3 inches. Both the knee and the hip were considerably flexed, and patient got about with difficulty. Her health was perfect.

The operation was performed, presumably without antiseptics, for Mr. Jameson seems to have acted on the suggestion given him seven years before, as he was about to depart for Cape Colony, not to supply himself with them. Mr. John Marshall had said to him, "You are going to an antiseptic climate and don't require them." Mr. Jameson remarks that this opinion had since been fully justified. Grave injuries, such as compound fractures, which in London would have made amputation imperative, healed at Cape Colony in a marvellously short time under some simple wet dressing, such as boracic lint.

10. (Group II.) **Fluhrer, W. F.** *Transperitoneal ligation of the left common iliac artery for aneurism of the external iliac.* Death on the seventh day from acute nephritis. (New York Med. Record, 1886, Oct. 26, p. 454.)

Male, colored, æt. 35. Admitted to Mount Sinai Hospital, May 3, 1886.

Four years before admission patient contracted syphilis. In September, 1885, he observed that the left lower limb and groin became "suddenly swollen and painful." Once the swelling in the groin was so great that he could hardly flex the thigh. Since then the swelling diminished, but at no time did it disappear.

Ten weeks before admission, the patient noticed a small, deeply seated pulsating tumor in the left groin. This steadily increased in size and in the force of its pulsations. The patient had lost twenty pounds in weight. He appeared to be only fairly vigorous.

Examination.—The tumor in the left groin was hardly noticeable on inspection, but on palpation it was found to be about two-thirds the size of a fist. From Poupart's ligament it extended upwards to a point about midway between the symphysis and the umbilicus; inwards it reached almost to the mid-line. Its pulsation was expansile, and accompanied by a faint systolic bruit. Pulsation in the left femoral artery, weaker than in the right, could be felt. The circulation of the limb on the affected side was good. There was no visible dilatation of the veins. The visceral examination revealed nothing abnormal. The urine's specific gravity was 1020, and in other respects it was normal.

Diagnosis.—Aneurism involving the whole extent of the external iliac artery.

The Operation (May 20) was conducted with thorough antiseptic precautions. The common iliac artery was tied off about one-quarter of an inch below the bifurcation of the aorta with a silk ligature, which had been boiled for two hours in a 5 per cent solution of carbolic acid. About one minute after the ligation a slowing[13] of twelve or fifteen beats was observed by Dr. Purroy, who was taking the radial pulse. Patient reacted well from the operation which had required two hours.

May 21. He complained of pains in the toes of the left foot. The circulation was "returning in the three lower toes." The urine contained albumen, hyaline casts, and some blood corpuscles.

May 23. The circulation was "good in the foot and toes." A pulse could be felt in the dorsalis pedis artery. Patient was restless. Urine was heavily charged with albumen, and contained hyaline casts in great numbers, and some blood corpuscles.

May 24. Pulse 140; temperature 102.6° F.

May 26. Patient's condition was grave. He was sluggish and unable to swallow.

May 27. Delirium. Died at 1 p. m.

Autopsy.—The abdominal wound had healed by first intention. The aneurism extended the whole length of the external iliac artery. The sac showed a tendency to form pouches. It was filled with a solid clot. The femoral vein was plugged with a firm, hard thrombus. The external iliac vein was impervious and lost upon the surface of the aneurism. "This condition of the veins accounts for the comparatively sudden œdema of the lower extremity and groin in the early history of the disease." The ligature had been applied three-fourths of an inch from the

[13] Compare with Schönborn's case in which the pulse was accelerated fifteen to twenty beats on tying the common iliac.

aneurism and one-fourth of an inch below the bifurcation of the aorta, and precisely at the point of crossing of the ureter. The common iliac vein lay exactly behind the artery. There was an aneurism of the aorta which began at the bifurcation and extended upwards for four inches. Calcified plates could be felt in the walls of the aneurism. In the sac was a clot which contrasted strongly with that which filled the aneurism of the external iliac. The former was pale, firm, laminated, and appeared adherent in places to the wall of the sac; it did not wholly obstruct the lumen of the aorta. "The remaining operative conditions," wrote Dr. Fluhrer, "that favored the development of nephritis were the prolonged and complete anesthetization and *the change in the renal circulation.*" (Italics mine.) "If the shutting off of the main arterial blood supply to one-fourth of the body caused such a disturbance of the general circulation as to be noticed by a slowing and increase in the volume of the radial pulse, surely there must have been a more intense effect upon the renal circulation, not only from the nearness of the renal arteries to the place of ligation, but also from the presence of the clot-containing aneurism of the aorta reaching to within two inches of their origin, which must have been an obstacle to the free delivery of blood to the lower channels."[12a]

11. (Group II). Smith, Thos. *Ligature of the right common iliac artery with kangaroo tendon for a large fusiform ileofemoral aneurism; yielding of the knot; re-ligature with silk; gangrene of the limb.* (Trans. of the Clin. Soc. of London, 1887, XX, 29.)

Male, æt. 52. Admitted to St. Bartholomew's Hospital, Oct. 14, 1885. An aneurism of the right external iliac artery extended from a point midway between the umbilicus and crural arch into the upper part of the thigh. The right thigh was much swollen, measuring 3 inches more than the left.

Oct. 22. Ligation of the common iliac artery just above the aneurism with kangaroo tendon. The vessel at the point of ligature was very large, and erroneously supposed to be the external iliac. The ligature was cut short and the wound drained.

Oct. 23. Pulsation, as forcible as before the operation of the previous day, returned in the aneurism. Fearing that the knot had slipped, the wound was opened and the common iliac re-ligated with two ligatures of carbolized silk. The knot of the original ligature was not obviously loose, but the point of an aneurism needle could be inserted between the kangaroo tendon and the vessel. The silk ligatures were cut short and the wound drained.

Oct. 24. "No pulsation in the sac. Leg warm, but darkish in color."

Oct. 25. "Pulsation evident in sac; leg mottled and purple . . . colder and insensible; thigh discolored."

Oct. 26. "Pulsation in the sac increasing; condition of the whole limb much improved, as regards color and temperature." Was this perhaps due to the fact that the circulation in the aneurism was being restored?

Oct. 27. "Pulsation in the sac continues, a slough forming in the calf."

Oct. 28. "Pulsation continued in sac, leg and foot becoming blue. Pulse 120; temperature 103° F."

Oct. 30. "Gangrene seems limited to foot and front part of leg; sac still pulsates."

Oct. 31. "Pulsation in sac less, and signs of a line of demarcation; patient's general condition a little better."

"During the next two days the line of demarcation became evident, and on November 2 amputation was performed just above the codyles."

The patient died November 3.

Autopsy.—"No general peritonitis, but some matting of the coils of intestines in the immediate neighborhood of the wound." Thrombosis of the external iliac, common femoral and profunda veins, and of the internal iliac, common femoral, superficial femoral and profunda arteries. The sac of the aneurism was quite filled with a firm laminated clot.

12. (Group II.) Lucas, Clement. *Transperitoneal ligation of the common iliac artery for aneurism of the external iliac.* "*Successful.*" (Brit. Med. Jour., 1892, Nov. 26, p. 1163. W. Mitchell Banks.)

Mr. Banks makes the following brief reference to a case of Mr. Clement Lucas: "Mr. Shileds' letter is obviously eliciting the necessary experience, as evidenced by Mr. Clement Lucas' communication, in which he reminds us of his successful case of ligature of the common iliac *through the peritoneum* for aneurism of the external iliac artery done three and a half years ago."

13. (Group I.) Meyer, Willy. *Ligation of the common iliac artery for secondary hemorrhage incident to ligation of the internal iliac arteries for enlargement of the prostate gland. Recovery.* (Annals of Surgery, 1894, XX, p. 44.)

Male, æt. 55, admitted to the German Hospital, New York, October, 1893, for enlargement of the prostate gland.

Oct. 5. Ligation of both internal iliac arteries (Bier), extraperitoneally, by Dr. Meyer. In the act of dividing the sheath of the left internal iliac, the point of the scalpel pricked the artery. The Hemorrhage was checked by the finger of an assistant on the common iliac, while Dr. Meyer ligated the artery above and below the wound in the vessel. He then divided the internal iliac between the ligatures. The hemorrhage ceased, but "suddenly it again set in in a most alarming way." The common iliac being once more compressed by an assistant's finger, it was seen that the ligature (catgut) had slipped from the proximal stump of the internal iliac. "Further attempts at properly placing a ligature proving futile, and bleeding continuing," a long artery clamp was placed on each end of the divided vessel. These were allowed to remain in the wound, being carefully packed about with gauze.

The operation on the right side was greatly facilitated by the Trendelenburg position. The right internal iliac was tied in two places with ligatures of catgut, and the artery was not divided. This wound was closed, layer by layer, without drainage.

On the fifth day, the clamps on the stumps of the left internal iliac were removed. The sutured wounds had healed throughout, the track of the forceps, of course, excepted.

"On the evening of the twelfth day, the patient suddenly noticed a hot feeling on the left side; secondary arterial hemorrhage had set in." Compression was promptly made by a well-trained nurse, then by the house surgeon who introduced his finger into the depths of the bleeding canal, and awaited the arrival of Dr. Meyer, who had been summoned. The patient was placed in the Trendelenburg posture, and the wound opened. Dr. Meyer found to his surprise that the bleeding came, not from the internal iliac, but from a hole in the external iliac artery. There was a defect, evidently caused by the pressure of a forceps,

[12a] I quite concur with this conclusion of Dr. Fluhrer as to the possible effect upon the function of the kidneys of obstruction of the arterial circulation below the renal arteries, and would refer the reader to a recent article by my former assistant, Dr. Gatch (Annals of Surgery, July, 1911, liv., p. 30), in which this question is considered. We observed in two cases that partial occlusion of the aorta in the human subject exerted a sudden and profound effect upon the renal findings. Dr. Gatch's careful study of these cases stimulated him to make experiments upon dogs and to determine the effect upon the kidneys of aortic obstruction in the healthy animal.

in the anterior wall of this vessel just below the bifurcation of the primitive trunk. So the external iliac was ligated below the hole, and the common iliac above it. The catgut ligatures cut through the latter twice, and hence a ligature of silk was applied close to the bifurcation of the aorta.

"Soon after the operation, gangrene of the toes and a part of the metatarsus developed, which later necessitated irregular amputation of the anterior part of the foot." The wound of the foot being healed, the patient began to walk about and left the hospital April 28.

So far as reduction in the size of the prostate, and the restoration of the function of the bladder were concerned, the result in the opinion of Dr. Meyer was "encouraging in the extreme." No mention is made in the report of pain in the limb following the ligation of the common iliac, nor is there any note concerning the function of this member.

14. (Group II.) Stevenson, W. F. *Transperitoneal ligation of the left common iliac for diffuse traumatic aneurism of the external iliac and femoral arteries. Recovery. Cure of aneurism.* (Lancet, London, 1896, Jan. 25, p. 224. Brigade-Surgeon-Lieutenant-Colonel W. F. Stevenson and Surgeon-Major H. I. Michael.)

Patient, æt. 35, was a sergeant in the artillery stationed at Dover Castle. About Oct. 12, 1895, patient slipped and fell with his left leg under him. He felt, at the time, a sharp pain in the left groin, but remained on duty for a week. Admitted to hospital, Oct. 19, 1895.

Examination.—The left leg was swollen and œdematous, and the superficial veins were distended. There was a large, forcibly pulsating swelling in the left groin extending from one inch above Poupart's ligament to six inches below it, and occupying almost the entire space between the anterior superior spine to the pubes. Patient was put to bed, his limb elevated and bandaged from the foot to the middle of the thigh.

Oct. 29. The tumor had become larger and was very painful. It was decided, on consultation, to ligate the common iliac on the following day. But on the thirtieth it was found that the tumor had become solid, and that the pulsation had almost ceased.

Nov. 4. No pulsation could be felt, although a faint bruit was still to be heard at a spot over the inner side of the swelling. The leg was much reduced in size, and its temperature was "fairly good." Apparently spontaneous cure was taking place and the collateral circulation being established.

Nov. 14. Slight pulsation had reappeared.

Nov. 15. The picture had entirely changed. Strong pulsation could be felt all over the tumor, which had enlarged in every direction. The local condition was much the same as on admission to the hospital.

First operation.—Aseptic precautions. Mid-line incision. Intestines were lifted out of the abdominal cavity. Ligation, with silk, of the left common iliac artery. Wound closed. Horse-hair suture of the skin. Pulsation in the tumor ceased on tying the ligature. It was the operator's intention to continue the operation in order to turn out the clots from the sac; but as the light was bad and the tumor flaccid, further operative procedure was deferred. The patient made an uninterrupted recovery from the laparotomy, his temperature at no time being above 99° F. The circulation in the limb was unimpaired. The tumor slowly diminished in size; the skin over it became loose and wrinkled. There was no return of the pulsation.

Second Operation.—Dec. 21. Two and a quarter pounds of soft blood clot were removed from a huge cavity in the upper, inner aspect of the thigh, extending from the bifurcation of the common iliac artery to the central end of Hunter's canal. There was so little hemorrhage during this operation that only one ligature was required. The cavity was packed with iodoformized gauze, and allowed to heal by granulation. The circulation of the leg was unimpaired.

15. (Group II.) McBurney, Chas. *Ligation of the left common iliac artery for aneurism of the external iliac. Recovery. Cure of aneurism.* (Annals of Surgery, 1898, XXVIII, 128.)

March 9, 1898. At a meeting of the New York Surgical Society, Dr. McBurney presented a young man, who, the year before, after lifting a heavy weight, felt a pain in the neighborhood of the left groin. A few weeks later he noticed a lump in that region, which gradually increased until it attained the size of a closed fist.

Examination.—The circulation in the limb of the affected side was good. The tumor presented all the characteristics of an aneurism. It terminated below at Poupart's ligament. It was decided that the ligation of the common iliac was indicated. This operation was performed December 18, 1897, transperitoneally, and through a long median abdominal incision. In order to reach the vessel it was necessary to lift out the intestines. On tying the double catgut ligature, pulsation in the aneurism ceased, and the sac rapidly diminished in size. The wound healed by first intention. There were not at any time signs of disturbance of the circulation of the limb. The patient was discharged one month after the operation. He was able to work, but still complained of some weakness in the left leg three months after the operation. There had been no return of the pulsation.

Dr. McBurney's report of the case is very brief. No mention is made of pains in the leg, in the days immediately following the operation.

16. (Group II.) Bryant, Jos. D. *Ligation of the right common iliac artery for aneurism of the external iliac. Died in three days.* (Annals of Surgery, 1898, XXVIII, 128.)

In the discussion of McBurney's case, Dr. Bryant stated that about five years before, at St. Vincent's Hospital, he ligated the right common iliac for the cure of a large aneurism of the external iliac artery, which had been present for a long time and caused the patient great distress.

He experienced some difficulty in locating the artery, as it was displaced considerably to the right side. On account of the anomalous position of this artery the left common iliac, correspondingly misplaced, narrowly escaped the ligation. The patient was in bad condition, and survived the operation only three days.

"At the autopsy it was found that the aorta rested and bifurcated on the right instead of the left side of the lumbar vertebrae." This anomaly, Dr. Bryant said, occurs in about 5 per cent of the cases.

17. (Group II.) von Büngner. *Ligation of the left common iliac artery for aneurism of the ischiadic artery. Excision of sac, gangrene.* Death. (R. v. Varendorff. Ueber die Verletzungen und Aneurysmen der Arteria glutea und ischiadica. Inaug. Dissertation, Marburg, 1899.)

Female, æt. 66, admitted to the Landkrankenhaus, June 11, 1898.

Anamnesis.—Suffered from rheumatism ten years ago, and since then from varicose veins and ulcers of the leg; otherwise, has always been well.

In November, 1897, she noticed, on placing her hand upon the left hip, a very distinct pulsation and heaving under it. Since that time a swelling forming in the gluteal region has been slowly but appreciably increasing in size, and assuming more and more the hemispherical form. Presently pains were felt starting in the tumor and radiating down the back of the thigh to the toes. Finally the pains became so severe as to be uncontrollable by morphia.

For the past few weeks she could lie only on the unaffected side, and with thigh and knee slightly flexed.

Status præsens.—Large, robust woman. Area of cardiac dullness slightly increased to the left and right. A blowing, mitral,

systolic murmur. The second pulmonary sound accentuated. Atheromatous arteries. Pulse 88-96, small and soft. Urine normal. Highly developed varices. Scars of healed leg-ulcers. On the left buttock is a tumefaction as large as the hand of a child which, synchronous with the pulse wave, rhythmically rises and falls. The tumor is 23 cm. high by 19 cm. broad. With the hand one feels very distinct pulsations, and constates that these do not become stronger when the tumor is pressed into the buttock. The tension in the tumor is so great that fluctuation can hardly be made out. A swishing bruit is to be heard everywhere over the tumefaction. Pelvic examination negative.

Diagnosis.—Spontaneous aneurism of the gluteal or sciatic artery; mitral insufficiency; general arteriosclerosis.

Operation.—June 14, 1898. (Prof. v. Büngner.) Patient on her right side. Aneurism when exposed was blue, very tense and strongly pulsating. In the endeavor to tie all the arteries leading to the aneurism (Philagrius) a little tear in the sac wall was made, and through this there spurted a powerful stream of blood. The hemorrhage was checked by the pressure of a finger. Attempts to close the hole with suture and forceps were made in vain, and always attended with great hemorrhage. So the finger pressure had to be relied upon while the operation for the ligation of the common iliac artery was being conducted, the right-sided position of the patient being continuously maintained.

This position was found to be so advantageous for the exposure of this artery that v. Varendorf urgently recommends it as greatly facilitating the performance of this operation. The external and common iliac arteries were plainly visible. The internal iliac which could be felt and, in its central portion, seen was found to be the seat of a fusiform aneurism throughout its entire length. Fearing to apply a ligature to an artery so diseased, the common iliac was tied as the only alternative. Immediately the pulsation and thrill ceased in the gluteal aneurism.

The abdominal wound was sutured and then, without much difficulty, the collapsed sac was removed and all the vessels from it ligated. It was, now, determined that the aneurism had its provenience in the sciatic artery. Rather troublesome was the tying off of the afferent sciatic artery, because the sac extended through the incisura ischiadica major into the pelvis. To facilitate the extirpation of the sac its posterior wall was split.[14]

The sciatic nerve was found to be so closely interwoven with the wall of the sac that it was thought to be necessary to remove about three-quarters of the circumference of this nerve.

On the following day, June 15, the patient's condition seemed to be satisfactory. The leg on the operated side felt warm, and its sensibility was preserved. No mention is made of pain in the limb.

June 16. p. m. Temperature 38.2°, pulse 142, and weak.

June 17. p. m. Temperature 38°, pulse 124. The left foot and leg felt cold, and sensation in them was lost. There were many deep, blue spots, irregular in outline and varying in size.

June 18. Patient became soporific. The blue spots were increased in size and number. Without the occurrence of other manifestations, the patient died at 11 p. m.

18. (Group II.) Körte, W. *Ligation of the right common iliac artery for ruptured aneurism of the external iliac. Consecutive ligation of the aorta. Death.* (Prof. W. Körte. Deutsche med. Wochenschrift, 1900, XXVI, 717.)

Male, æt. 28.

Anamnesis.—After an excessively wearisome journey in the mountains patient was seized with severe pains in the joints. Simultaneously there appeared nodules on the extremities which disappeared after taking iodide of potassium.

Early in March, 1899, patient observed a painless, pulsating swelling above the flexure of the groin. After a long bicycle ride on April 1, he experienced pain so severe that he was compelled to lie down. The right leg could not be used; the pains radiated down the front of the thigh, and acquired such intensity that he applied for admission to the Stadtisches Krankenhaus am Urban, Berlin, April 15, 1899.

Status.—A tall, lean, powerful, anemic man. Temperature 38, pulse 100-110, and easily compressible. The right limb somewhat œdematous and slightly flexed at the hip; cannot be voluntarily moved. Passive movements normal.

Above Poupart's ligament, on the right side, is a pulsating tumor the size of a large apple. The walls are tensely expanded. Distinct thrill and bruit over the tumor, and extending to the left to within about 4 cm. from the mid-line, and to the right to the outer edge of the right rectus muscle. Beyond these limits there is a resistant mass which entirely fills the right iliac fossa, extends upwards to the edge of the ribs and backwards to the long muscles of the spine. The pulsating tumor extends above to a point midway between navel and symphysis, and below to Poupart's ligament. Scarpa's triangle is filled out in such manner as to press forward the strongly pulsating femoral artery. Per rectum a thickening of the soft parts on the right pelvic wall is appreciable, and the pulsating tumor can be felt.

Compression of the aorta and of the right common iliac arrests the pulsation in the tumor. The heart is enlarged to the left. Over the aorta a diastolic murmur is to be heard and felt. Radial arteries tortuous. Urine free from albumen and sugar.

Diagnosis.—Aneurism of the right external iliac, ruptured; extensive extravasation of blood; aortic insufficiency and perhaps aneurism at the beginning of the aorta. Intraperitoneal ligation of the common iliac was determined upon. The extraperitoneal route was distinctly contraindicated because of the extravasated blood.

Operation.—April 17, 1899. Ligation of the common iliac with catgut. Pulsation in the aneurism thereupon ceased. For a few hours the right extremity was pale, but soon became warm and natural in color. Otherwise no disturbances of the circulation resulted from the ligation. In the femoral artery a slight pulsation was discernible. The toes could be moved; sensation remained unchanged. But for three days there were signs of intestinal paresis, nausea, singultus and tympany.

In the washing of the stomach, great quantities of dark fluid containing material resembling coffee-grounds were evacuated, and the first stools were blackish, as if blood-stained. It was concluded that the sub-peritoneal extravasation had either perforated the bowel at some point, or that it had compressed the mesenteric vessels (of the duodenum or ascending colon).

The sac of the aneurism remained pulseless and without bruit. The large hæmatoma on the right side did not, however, diminish in size and continued to cause distress.

On the second right intercostal space, alongside of the sternum, a pulsation, which could be seen and felt became manifest. Over this area systolic and diastolic murmurs were heard. On the 6th of May, and afterwards, there were signs of thrombosis of the femoral vein. The general condition of the patient did not improve; he remained pale, his pulse became more rapid, his temperature remaining normal, and he complained continually of pains in the hæmatoma, which radiated to the sacrum. The active movements of the right limb became more limited and, towards the middle of May the right leg was flexed at the hip. The hæmatoma in the right iliac fossa became very tense. Pulsation could not be perceived either in the aneurismal sac or in the extravasation, and was greatly diminished in force in the femoral artery. It was thought that the circulation in the

[14] It has, for many years, been a favorite procedure with surgeons to split, in two or in many parts, benign tumors otherwise difficult of removal. (*i. e.*, lipomata of the back of the neck.)

aneurism must have ceased, and that the perianeurismal hæmatoma had no direct communication with the blood stream. But as the patient remained unrelieved of his pain, it seemed indicated to open and empty the sac in the manner which had recently been recommended by Mikulicz.[15]

So 37 days after the first operation, on the 23d of May, 1899, a second was undertaken. The incision led into great masses of coagulated blood, which were extruded under great pressure. The tumor collapsed. As the cavity was almost completely emptied there took place, suddenly, a profuse arterial hemorrhage. This could, for a time only, be arrested by compression and tamponade. To search for the bleeding point in the enormous hole partly filled with coagula seemed unwise. Therefore, transperitoneally, through a mid-line incision, the aorta was ligated, at first over a little bunch of gauze. Thereupon the bleeding ceased. Then, through a long cut in the right flank, Prof. Körte completely evacuated the contents of the enormous cavity. At the right edge of the true pelvis, in the neighborhood of the internal iliac, he encountered a bright, but trivial hemorrhage which was controlled by pressure. The aortic ligature was now definitely tied and the wounds sutured. The patient was greatly collapsed, and died one hour after the operation.

At the autopsy it was determined that the patient suffered from widespread disease of the arterial system, which had led to the formation of aneurism of the aorta, right and external iliac, right femoral and right profunda femoris arteries.

19. (Group II.) Martin, A. A. *Ligation of the left common iliac artery for aneurism from a bullet wound of the external iliac. Recovery. Cure of aneurism.* By Arthur A. Martin, M. B., Ch. B. Edin., Civil Surgeon, South African Field Force. (Communicated by the Director-General, Army Medical Service. Brit. Med. Jour., Jan. 17, 1903.)

Private soldier, æt. 31. Admitted, Nov. 18, 1901, to General Hospital, Howick, Natal.

Examination.—Healed bullet wound of left groin. The wound of entrance was about three fingers' breadth above Poupart's ligament and internal to the external iliac artery. The wound of exit was below the crest of the ilium of the same side. The bullet had crossed the external iliac, "wounded the artery high up," and pierced the iliac bone. A marked bulging, expansive pulsation and bruit were noted, and the diagnosis of aneurism made.

Nov. 23. The aneurism, which had greatly increased in size, now extended a fingers' breadth below the umbilicus and to the middle line. The patient's temperature was 101.6° F.

Operation.—The incision began one and one-half inches above the center of Poupart's ligament, and extended to one inch above and internal to the anterior superior spine. The fascia and muscles were cut through in the line of the skin incision which, being found too short, was prolonged upwards in a curve with the convexity downwards and outwards. Peritoneum incised. The external iliac artery could not be defined. The common and internal iliac arteries seemed to enter the upper part of the aneurismal mass. The former artery, twice ligated, was divided between the ligatures of double silk. Wound undrained and sealed. The limb was enveloped in cotton wool and firmly bandaged.

Nov. 25. Patient said he could not "feel" his left leg.

Nov. 26. Vomited several times. No abdominal distension. The left leg was much colder than the right. "Roots of the toes very œdematous." Limb blanched. Skin below the knee quite anesthetic. No pulsation in tibial or popliteal.

Nov. 27. Large watery blebs on leg and foot. Anesthesia below the knee unchanged. No pain in groin since operation.

[15] Zur operativen Behandlungen der Aneurysmen. Beiträge zur klin. Chirurgie, Band XXIV, 5, 418. Hoffman.

Nov. 30. Patient could "feel" his leg, which seemed "heavy as lead." Temperature of left leg nearly equal to that of the other side. Blisters and œdema vanished.

Dec. 22. The mass in iliac was smaller, hard and without pulsation.

Jan. —, 1902. Patient could easily flex, extend and rotate leg, but was unable to "lift it vertically" when lying on the back.

Feb. 3. Could walk about slowly. The mass in the left iliac fossa reduced to size of a goose egg.

The author makes the important comment that "the deep epigastric and deep circumflex iliac arteries fortunately came off below the aneurism."

20. (Group II.) Maynard, F. P. *Ligation of the right common iliac artery for diffused iliac aneurism. Death.* (The Indian Med. Gazette, Calcutta, 1903, p. 253. F. P. Maynard, F. R. C. S. (Eng.), Major I. M. S., Surgeon Superintendent, Mayo Native Hospital, Calcutta.)

Male, native, æt. 32. Admitted, April 17, 1903, to the Mayo Hospital.

History.—Patient had never had any venereal disease. Four or five months before admission he noticed a pulsating tumor in the right groin. Growing gradually larger, it did not pain him severely until a month later, when it began to increase rapidly in size.

April 7, after a stool, he felt "as if a gust of wind ran from his abdomen into the scrotum." Thereupon he noticed that the penis and scrotum had swelled, and experienced pain in these parts.

Status.—A tall, thin man with anxious expression. Pulse 99; respiration normal; temperature 100.8° F.; cough, but no physical signs of tuberculosis. Urine normal. A large, tense, rounded, pulsating tumor, occupying the right inguinal region, extended from about 2 inches below navel to 3 or 4 inches below Poupart's ligament. This swelling was continuous with the swollen scrotum, which also had expansile pulsation synchronous with the heart's systole. A loud systolic bruit, heard over the entire area of pulsation, was loudest at the upper and outer part of the tumefaction. The penis was very œdematous. The abdominal wall, as high as the left nipple, and the upper fourth of the left thigh showed a brownish discoloration from subcutaneous hemorrhage. Feeble pulsation could be felt in the right femoral and tibial arteries.

April 20. A portion of the scrotum had become black and anesthetic.

Operation.—An abdominal incision, in the mid-line, was carried below into the area of subcutaneous hemorrhage, where troublesome bleeding was encountered. The intestines gave great annoyance, and had to be brought out of the belly, where they were wrapped in warm, sterile towels. The operator regretted that he had not arranged for the Trendelenburg position. Three strands of silk were passed under the common iliac artery without difficulty. These were not drawn so tightly in tying as to cut through the inner arterial coats. Pulsation in the swelling ceased on tying the ligature.

April 21. Patient developed bronchitis and vomited occasionally.

April 22. Abdomen tympanitic. The aneurism was hard, the scrotum and toes warm. Bronchitis better.

April 24. Had several stools (diarrhœa), accompanied by the passage of some gas. The heat (106° F. in the shade) was very oppressive.

April 26. The diarrhœa and vomiting persisted. The aneurism had decreased in size. The wound seemed to be healed.

On the evening of the 27th, patient had several loose stools,

and died quite suddenly. A post-mortem examination was not permitted.

The circulation of the extremity had not been manifestly affected by the operation.

21. (Group I.) Czerny, V. *Ligation of the left common iliac for the arrest of hemorrhage from a small branch of this artery torn from the parent-stem in the course of operation for the removal of tuberculous glands.* (Dreist. Deutsche Zeitschrift f. Chirurgie, 1904, p. 10.)

Male, æt. 28. Admitted to the surgical clinic for pelvic tumor. Had four years previously been admitted to the hospital for traumatic hæmarthrosis genu and hæmatoma femoris.

Examination.—The tumor in the pelvis, although quite hard, gave evidence of fluctuation. It was movable on the ilium. Per rectum there was felt, in the neighborhood of the symphysis sacroiliaca dextra, a resistent body lying upon the bone, which it was thought might be an exudate.

Diagnosis.—Lymph glands, suppurating, and probably tuberculous.

Operation.—Feb. 26, 1897, by Prof. Czerny. Nodular masses composed of glands were, without much difficulty removed from along the inner edge of the ilio-psoas muscle, but not so easily from the external iliac artery, which for 5 cm. was imbedded in them, mesially. In separating the packet of glands from the vessels, a small branch of the common iliac artery was torn off so near its parent stem that ligation of the latter, being considered imperative, was done. Three ligatures of thick catgut were employed, but not drawn so tight as to cut through the arterial wall. Other conglomerations were found, *i. e.*, in the pelvis and præsacral area. The removal of the diseased glands was continued without other untoward incident. It was constated that the deep epigastric vessels were not injured. The wound was tamponed.

During the first two days the left extremity was somewhat cold. There was no disturbance of sensation following the operation, nor was there any pain.

On and after the 10th of March, there were irregular elevations of temperature, at first associated with frontal headaches. Pulmonic râles were detected; then followed night sweats and slight expectoration, and on the 30th of July, 1897, the patient died of acute miliary tuberculosis.

At autopsy a double ligature was found on the common iliac artery, with associated thrombus extending to the bifurcation of the aorta. The collateral circulation seemed to have been established largely by means of anastomosis between the internal iliac arteries of the two sides without the presence of any large communicating branch.

22. Kuster, Ernst. *Ligation of the left common iliac and other arteries for elephantiasis of the lower extremities. Result negative.* (Karl Dreist, Deutsche Zeitschrift fur Chirurgie, 1904, LXXI, 32.)

Female, æt. 17. Admitted, Dec. 3, 1897, to the surgical clinic of the University of Marburg.

Anamnesis.—Parents and five brothers and sisters alive and well. Two years ago, just after illness with nettle-rash, both legs became swollen, but without causing any discomfort. The swelling has steadily increased. Menstruation began in her 16th year and has always been irregular.

Status on Admission.—Body well nourished. Skin rather pale. Findings in thorax and abdomen normal. Pulse slow and somewhat irregular. Urine normal. Both lower extremities large and shapeless. Thighs 54 cm. in circumference. The left calf 45 cm. The feet are uninvolved. The skin feels abnormally solid; its veins here and there are dilated. There are telangiectases on the chest, left arm, forearm and hand.

Treatment.—Elevation of the limbs and compression.

Dec. 8. The swelling of the thighs is diminished by 6 cm.; of the legs by 5 cm.

Dec. 20, a. m. Allowed to stand for the first time; p. m., the legs are again as large as ever.

Jan. 7, 1898. *Ligation of the right femoral artery below Poupart's ligament.* The subcutaneous fat was so thick that the finding of the artery was very difficult. The limb became paler after the operation.

Jan. 18. Decided decrease in the circumference of the right extremity. The skin has become softer.

Jan. 28. *Ligation of the left femoral artery below Poupart's ligament.*

Feb. 10. Reduction in size of the left limb.

Feb. 25. Patient being permitted to stand, the swelling promptly increased.

March 8. *Extraperitoneal ligation of the right external iliac.* The vessel was very small. Tamponade. Erysipelas.

April 24. Extremities normal in size.

April 30. Patient allowed to walk. No swelling observable in the evening.

May 12. Swelling as great as on admission.

June 23. *Extraperitoneal ligation of the left common iliac.* Limb cooler towards evening.

June 27. Temperature of both extremities the same.

Aug. 2. Result of the operations negative.

23. (Group I.) Trendelenburg, Friedrich. *Ligation of the left common artery for aneurisma dissecans of this vessel. Death.* (Communicated by Dreist, l. c., p. 12.)

Male, æt. 60. Admitted, Oct. 4, 1898, to Prof. Trendelenburg's clinic in Leipzig.

Examination.—General condition wretched. Patient had suffered from pain in the abdomen for a year, and on the day of admission had done a full day's work, although repeatedly complaining to his fellow laborers of drawing pains. Suddenly, about 6 p. m., very severe pains set in, and he rapidly became pale and weak.

Status on Admission.—Patient very pale and in great pain. There was eructation but no vomiting. The abdomen was greatly distended. Liver dullness normal. On the left side of the abdomen was palpated a tense, elongated tumor of the size of one's arm, which, in its course, corresponded to the situation of the descending colon. The percussion note, nowhere metallic, was dull over the tumor. Nevertheless it was thought that perhaps there was volvulus of the sigmoid flexure, and an exploratory laparotomy was promptly made.

On incision of the abdominal wall, a large amount of blood was observed extravasated in the præperitoneal space. The hand in the abdominal cavity ascertained that the tumor was retroperitoneal.

An incision was made into this hæmatoma. On removal of coagula there was, at first, no fresh bleeding, and there was found at the bottom of the large cavity a pulsating aneurism with rounded surface, which led towards the aorta, but was situated between the lumbar vertebræ and the psoas muscle. Suddenly there spurted from the aneurism a thick stream of blood. Compression was made; but under the compressing finger the rent in the aneurism became greater, whereupon the blood welled forth in a great flood.

The aneurism was laid freely open, and a ligature applied to its root, near the aorta. Hemorrhage from the distal side was controlled by a clamp and by tying off the rent with a strip of gauze. Skin suture. Infusion of 900 cc. salt solution. Patient awoke from the narcosis, evinced great restlessness, and died in three hours.

Autopsy.—Dissecting aneurism of the right common iliac. Fusiform aneurism of the left common iliac, the size of a hen's egg, immediately below the aortic bifurcation. A tear of the intima, in the middle of the aneurism, transverse to its long axis. Diffuse arteriosclerosis of the entire aorta. Arteriosclerosis with calcareous infiltration of the right coronary artery of the heart and of both iliacs.

24. (Group II.) Christel. *Ligation of the left common iliac artery for spurious aneurism of the femoral. Recovery. Gangrene.* (Dreist, l. c., p. 6.)

Male, æt, 28. Blacksmith. On Jan. 28, 1901, a glowing splinter of iron penetrated the left thigh, and thereupon a strong pulsating stream of blood spurted from the wound. Patient controlled the bleeding with his thumb until the arrival of a physician, who applied a compressing bandage. Eight days after the injury, patient was allowed to go about. Severe pains, with tension in Scarpa's triangle, compelled him to take to his bed again. The swelling increased and the pains became unbearable.

March 1, 1901. Admitted to Rombacher Spital, Metz.

Status.—March 5. Patient was greatly emaciated and anemic. Resembled a consumptive in the last stages of the disease. Pulse, thready (126+). Rectal temperature 36.7°. Left thigh enormously swollen. A small scar, 10 cm. below anterior superior spine, along the inner edge of the sartorius. The œdema extended to the level of the navel. Skin of the thigh livid, and its veins distended in the region of the tumor. Auscultation over it negative. Pulsation in the posterior tibial artery was distinct.

Diagnosis.—Spurious aneurism, with beginning suppuration of the femoral or a branch of this artery.

Operation.—March 6. Incision over the greatest convexity of the tumor led into a large hole, between the extensor and adductor muscles, lined with coagula. The femoral vein was thick as a finger, tensely full and non-pulsating. Blood welled up from the depths of the wound. Attempts to remove the clots from the infiltrated and friable tissues caused such very profuse bleeding that they were abandoned. Preparations made for the ligation of the external iliac. An incision parallel to Poupart's ligament laid bare this artery, which was then ligated below the origin of the deep epigastric, because the latter vessel was given off at an abnormally high point. During the manipulations, the epigastric was torn off and ligated. The external iliac was again ligated above the origin of the epigastric.

Then the wound of the thigh, which had been tamponed with gauze, was reinvestigated. There was still bleeding from several unrecognizable sources. The patient was so collapsed that a further loss of blood could not be sustained. Hence it was determined to ligate the common iliac. This was done extraperitoneally. The bleeding from the wound of the thigh was thereby arrested. The femoral artery was again searched for in this wound but not found. Both wounds were tamponed with iodoform-gauze.

"After a time," the left leg became cold and insensible. A livid discoloration of the foot appeared. The gangrene extended gradually. A line of demarcation formed about the junction of the middle and upper thirds of the leg. The patient became soporific. Pulse 124; temperature 103.5° F. Notwithstanding the desperate condition of the patient, Dr. Christel amputated "the same day." Gradual recovery took place, and Oct. 6, 1901, the patient was supplied with a prothesis.

In March, 1903, Dr. Dreist again saw the patient, who had entirely regained his health.

Whether it was the femoral, or a branch of this artery, which had been injured by the iron splinter, was never determined. What vessels besides those mentioned may have been ligated or injured is not known. It is at least certain that the gangrene is not to be attributed solely to the ligation of the common iliac. Inasmuch as the external iliac was ligated above and below the torn off epigastric artery, it is probable that the circumflex iliac also had its origin between these ligatures. The profunda femoris with its circumflex branches may have been injured either by the iron splinter or in the attempts to check the hemorrhage from the wound of the thigh.

25. (Group I.) Clark, Henry E., C. M. G. Senior Surgeon, Glasgow Royal Infirmary. *Ligation of the left profunda femoral and common iliac arteries for wound of the profunda artery and vein. Recovery.* (Brit. Med. Jour., Oct. 7, 1905, p. 850.)

This case is so briefly and picturesquely reported that I retell the story in the words of the operator.

"H. B. Porter, aged 26, was admitted into Ward 25, Glasgow Royal Infirmary, on April 25, 1899, suffering from a small punctured wound at the inner side of the left thigh, at the junction of the upper and middle third.

"His story was that he and another man were having a fight, when the latter whipped out a penknife and came at him. In trying to escape from the assault, he fell, and his assailant fell on top of him, and the blade of the knife ran into the thigh, right up to the hilt. The wound bled very freely, but a doctor was soon in attendance, who put on a pad and a bandage. When he reached the hospital the bleeding had ceased, and on the following morning, when I saw him at the usual visit hour, the wound was so well plugged with clot that I thought it unwise to disturb it. All went well till May 12, when the wound was found to be bleeding freely, suppuration having taken place, and the clot having consequently broken down. I thoroughly opened up the wound, and exposed the main trunk of the profunda femoris artery, which had been incompletely divided; this was double ligatured and cut across. The vein was also found to be injured, and was more difficult to secure effectively than the artery.

"Three days afterwards (on May 15), when the patient was using the bedpan, he became suddenly blanched and pulseless, and the dressings became saturated with arterial blood. I was fortunately on the spot at the time, and at once took him to the operating theater, where I ligatured the common femoral artery just at its emergence from beneath Poupart's ligament. This arrested the bleeding, and he very rapidly recovered from the loss of blood, until five days later (May 20), when a still more serious hemorrhage took place. On this occasion, also, I happened to be in the infirmary and at once applied an elastic bandage round the pelvis and hip, but as this did not control the bleeding, it was decided to ligature the common iliac artery. This was done by Sir Philip Crampton's method, as described by him in the Medico-Chirurgical Transactions, Vol. XVI, p. 161, as far back as 1828. The incision commenced at the anterior extremity of the last rib, proceeded downwards directly to the ilium, then followed the line of the crest, but keeping a little within its inner margin, until it terminated at the anterior superior spine. The abdominal muscles were divided in the full extent of this incision till the peritoneum was reached, when that structure with the contained intestines was lifted up off the iliac and the lumbar fasciæ. The ureter was raised with the peritoneum. An excellent view of the external and common iliac arteries was obtained, and the bleeding was slight and easily controlled. By means of a helix-curve aneurism needle the common iliac artery was freed from a small amount of fat, and a strong chromic gut ligature passed and securely tied. The large wound was for the most part stitched up in layers, but the part in the loin was packed with iodoform gauze. The patient stood the operation well, and made up rapidly for the loss of blood. Unfortunately, the wound suppurated, but this was not wonderful, considering that there had been all along an infection of the original wound, probably from septic material carried in by the knife. This, however, materially delayed the healing,

and it was not till August 11 that he was dismissed to the Convalescent Home.

"After leaving the wards he was only seen once by me, as he found it impossible to come to the infirmary on week-days. He was seen by one of my dressers, and also by my staff-nurse fully six months after leaving us, and was then in full employment as an outside porter at the Glasgow Central Railway Station. I understood his work to consist mainly in taking commercial travellers' large sample boxes on a hand-barrow about the town—a sufficiently trying and laborious occupation. It is not too much, I think, to claim this not only as a 'recovery' but as a perfect cure."

26. (Group II.) Cranwell, D. I. *Ligation of the right common iliac for aneurism of the external iliac and femoral arteries. Gangrene. Death.* (Tratamiento de los anuerismos de la iliaca externa. Por el doctor Daniel J. Cranwell, Profesor suplente de clinica quirurgica. Revista de la Sociedad Médica Argentina, 1906, Vol. XIV, p. 388.)

Male, æt. 48. Blenorrhagia at the age of 16 years. Alcoholic. Thirty years ago, after a walk, he suffered with cramps in the right leg which made him halt. Later, a small tumor appeared in the right groin which for 15 years grew slowly, and then more rapidly, until August, 1903, when he received a blow in the affected regions. Ever since then the growth has increased and the leg has been swelling. For the past 30 years he has had intermittent pains in the lower part of the thigh at the base of Scarpa's triangle and in the knee, which were greater at night and with exercise.

Status.—A very lean individual in bad general condition. The thigh is flexed, abducted and rotated outwards. Occupying the base of Scarpa's triangle and the right iliac fossa, there is a tumor as large as the head of a child. Poupart's ligament indents the mass, the lower part of which, as big as an orange, is somewhat drawn out in the course of the femoral vessels. The skin over it is normal, and not adherent to the underlying tumor. The swelling is soft and expands with pulsation. The thigh and leg are œdematous. Patient suffers excruciating pain in the hip and inner part of the thigh. Motions of the joint are greatly restricted because of the pain. He has numerous subcutaneous lipomata and general arteriosclerosis.

Diagnosis.—Aneurism of the external iliac and femoral arteries.

Operation.—Feb. 28, 1904 (?). Trendelenburg position, median incision. Transperitoneal ligation of the right common iliac just below the bifurcation of the aorta. Immediate cessation of pulsation in the aneurism.

March 1. The leg was livid and without sensation from the calf to the toes.

March 2. Gangrene of the leg. Amputation about the middle of the thigh.

The patient's general condition improved for a time, but the wound showed no tendency to heal. The arteries were rigid and pulsated forcefully.

April 4. Sacral decubitus. Death.

27. (Group II.) Gillette, Wm. D. *Ligation of the left common iliac artery for the cure of ischiadic aneurism. The internal and external iliacs were also ligated and the sac dissected out and tied off. Gangrene.* (Annals of Surgery, 1908, XXXVIII, 22.)

Patient, male, æt. 56. Aneurism of left sciatic artery attributed to severe fall about 17 months prior to operation. The aneurism extended so high towards the pelvis that ligation of the afferent artery was not attempted. So (April 22, 1905) the left internal iliac was tied near its origin. The patient recovered uneventfully. Pulsation ceased in the aneurism, which rapidly diminished in size. For seven months a cure was believed to have been effected. Then pulsation reappeared in a small tumor at the original site of the aneurism. Patient did not consent to further operation until three months later, when the aneurism had greatly enlarged, although not to its former dimensions, April 18, 1906. Dr. Gillette exposed the pulsating tumor in the buttock, hoping to ligate the artery leading to it, or to perform the Matas operation. Neither procedure was feasible. The abdomen was then opened and, as compression of the external iliac artery seemed to obliterate the pulsation in the aneurism, this artery was ligated. But on re-examination of the tumor, it was found that the pulsation had not been affected in the least. So the common iliac artery was tied close to the aortic bifurcation. Then, through the incision in the buttock, the sac of the aneurism was freely opened and tied off at the highest possible point.

On the third day signs of gangrene of the leg appeared, and on the sixth day amputation was made at the juncture of the upper and middle thirds of the leg. Sloughing of the flaps necessitated amputation of the thigh. Recovery.

28. (Group II.) Halsted, W. S. *Occlusion of the left common iliac with an aluminum band for aneurism of the external iliac and femoral arteries. Recovery. Aneurism cured. (Case hitherto unreported.)*

M. R., German, æt. 44, was admitted to the Johns Hopkins Hospital December 28, 1908, complaining of tumefaction and pain in the left groin.

Story.—Has always enjoyed good health. Believes that he had malaria at some time. Contracted specific urethritis at the age of 22, and at the same time a venereal sore which was accompanied by enlarged inguinal glands. Has had no secondary manifestations of lues. Drinks two bottles of beer daily, is otherwise temperate. About two and one-fourth years ago, patient in falling, was struck in the left groin with the iron-bound edge of a barrel. He suffered no immediate inconvenience from the trauma, but three months later felt a "drawing" pain in the left groin and leg. This pain was especially severe in the calf, and prevented him from doing much walking.

Four or five months after the injury, the leg began to swell. About September, 1908, the pain ceased, in the leg, but increased in the groin, where it assumed a "burning character." More than one and a half years ago a lump in the groin was noticed. This has been "getting larger" and tender, and patient has observed that it pulsates. The burning pains in the swelling are intensified by walking.

Status præsens.—Patient is well nourished and seems to be robust. Examination of the eyes, ears, nose, mouth, chest and rectum reveals nothing abnormal. Radial and temporal arteries slightly hard and tortuous. Pulse 90. Cicatrices in both groins. In the left groin is a large, very tense pulsating mass, over which the skin, œdematous, reddish and glistening, is tightly stretched. The swelling extends laterally to the anterior superior spine of the ilium, mesially to the mid-line, upwards to within 8 cm. of the umbilicus and downwards to a point 12 cm. below Poupart's ligament. It measures 26 cm. in the transverse, and 20 cm. in the longitudinal diameter. It has forced the external ring downwards and the canal forwards, so that the finger cannot enter the former. The mass expands in all directions with the pulsation, the heave from which is so strong that motion is communicated to the penis and scrotum with each heart-beat. A loud systolic bruit is to be heard, and a thrill to be felt, over the tumor.

The right foot is colder than the left. Pulsation in the popliteal, posterior tibial and dorsalis pedis arteries is not perceivable. The left thigh at 20 cm. above the patella measures 51.5 cm., the right 47 cm.; the left calf 35 cm. the right 30.5 cm. The veins and venules of the left limb are enlarged. Sensation and motility are normal. White blood corpuscles 8400. Hæmoglobin 81 per cent (Sahli).

There seems to be a delay of pulsation in the tumor of three hundredths of a second. The lower edge of the swelling is abrupt, and a little overhanging. The patient rests most comfortably with the thigh slightly flexed and abducted. There is an apparent lengthening of 3 cm. of the left lower extremity.

The temperature was usually 0.5 of a degree (Fahr.) higher in the left than in the right popliteal space.

Diagnosis.—Aneurism of the external iliac and femoral arteries.

Operation.—Jan. 11, 1909. Application of a totally occluding aluminum band to the left common iliac artery. The patient was placed in the Trendelenburg position to compel gravitation of the intestines towards the thorax.[16] A vertical incision was made through the middle of the anterior sheath of the rectus muscle. This muscle was then split near its inner edge, and its external portion retracted outwards. The posterior sheath of this muscle, the fascia tranversalis and the peritoneum were divided about in the line of the incision through the anterior sheath and skin.

It was my intention to ligate the external iliac artery if possible. The upper side of the huge aneurism presented a vertical face which seemed to be almost flat, and the external iliac artery lay at a great depth behind the aneurism. A very thick panniculus considerably increased the distance of the artery from the skin. The vertical diameter of the aneurism at its upper edge was estimated at 12 cm. to 13 cm. We possessed no retractors which could reach to the bottom of the wound, but by means of broad spatulæ and the hand of an assistant, the intestines, which had been carefully displaced upwards and to the right side, were kept easily out of the way.

The left ureter promptly came into view, and beneath it the common iliac artery was recognized. This was readily isolated by means of two long fine blunt dissectors, designed especially for the dissection of the deep arteries (*i. e.*, the inferior thyroid). The left common iliac being raised from its bed by two narrow tapes, an armed band roller was passed under it in the usual manner,[17] and the band (6 cm. wide) curled by the instrument. On releasing the traction-pressure made on the artery by the tapes, the expanded vessel not only completely filled the band, but was constricted by it. A very slight additional rolling of the band with the fingers sufficed to arrest the pulsation in the aneurism, but not altogether in the common iliac artery.

The thrill, however, which is observed with a certain amount of partial occlusion of an artery had vanished. A little additional rolling of the band—so little that I was not able to appreciate with the fingers that a further constriction had been accomplished—shut the pulse off completely from the artery, which assumed a flattish shape and the almost collapsed appearance characteristic of empty arteries. The peritoneum, transversalis fascia and posterior sheath of the rectus were closed with a continuous catgut suture, and the anterior sheath of this muscle in the same manner. The subcutaneous fascia was stitched with interrupted sutures of very fine silver wire. A continuous buried mattress suture of strong silver wire was employed for the skin, because considerable traction was necessary to bring its slightly inflamed edges together over the tumor. Under such conditions catgut is useless, and silk would prove a nuisance should suppuration occur. Where there is tension of the skin, the buried silver wire suture has proved, in our experience, to be the best. The wound was covered with silver foil.

Returned to the ward at 1.45 p. m., the patient's pulse was 100, his temperature 97° F. There was no return of pulsation in the aneurism. During the afternoon he was restless and complained of pain in the left leg. The left foot seemed cooler than the right, but was of good color, though the circulation was somewhat impeded. There was no impairment of motion or sensation.

3.20 p. m. The temperature in the popliteal space is 97.4° F. on the left, 97.3° F. on the right side. At 6 p. m. the temperature of the feet is relatively the same on both sides as at 3.20 p. m., but in the popliteal space, and for a short distance down the leg, it is a few tenths of a degree higher on the left than on the other side.

Until midnight the color of the foot remained apparently unchanged. Then there seemed to be a slightly bluish tinge of the skin of the left foot, which remained for not more than two hours. At no time did the patient observe any unusual sensations in the foot, but he complained of excruciating pain in the left leg between the knee and ankle, and in no other place. Something seemed to be "bearing down on the bone, hard enough to break it." Over a small area, about 3 cm. in width, on the inner side of the calf of the left leg, the touch of the finger could not be appreciated.

Jan. 12, 8 a. m. The patient's condition is highly satisfactory. The pain in the leg which persisted during the night has almost vanished. The circulation in the left foot is improved. Temperature in popliteal space 96.8° F. on the left, 96.4° F. on the right side.

9 p. m. The swelling in the limb is diminishing; the measurements showing 2.5 cm. decrease in size at 10 cm. and 20 cm. above the patella.

Jan. 13. Patient passed a comfortable night, with very little pain in the leg. The foot has remained warm and its color good. There is little distension of the abdomen. At 8 a. m., temperature 99.4° F., pulse 120, respiration 20. There is no perceptible pulsation in the aneurism or in the arteries below. The tumor seems to be softer.

8 p. m. Temperature in popliteal space, right 98.2° F., left 98° F.

Jan. 14. Abdominal distension entirely relieved.

Jan. 15. Aneurismal mass seems flatter and softer. There is no observable pulsation.

Jan. 17. *First dressing.* The tense skin is reddened along the greater part of incision, about the middle of which there is a gaping of nearly 4 cm. Patient says, "I have never felt better in my life."

Jan. 20. The redness of the skin has about disappeared. There has been no further separation of the edges of the wound, the exudate from which is still serous. The swelling of the leg continues to decrease. No pulsation in the aneurism or arteries of the extremity.

Jan. 31. Aneurismal mass measures 13.5 cm. by 15.5 cm. Apparent lengthening of left leg is still 2 cm. (abduction).

Feb. 8. Patient has been up in a chair for the past three days. There has been no swelling of the leg incident to its dependent posture. No pulsation in the tumor. The wound is healed.

Feb. 10. Patient walks without difficulty or discomfort. There is no swelling of the foot.

Feb. 12. Slight pain in calf, relieved by massage. Left foot and leg slightly cyanosed.

Feb. 15, 1909. Sensation of entire leg normal, but at the inner side of the thigh, just below the groin, there is an area about 9 cm. long over which the patient is unable to distinguish heat and cold accurately, or to appreciate the difference between the lightly applied point and the head of a pin. The tumor mass is smaller, harder, more sharply circumscribed, and without pulsation. Patient discharged.

Jan. 19, 1910, *one year after the operation.* Patient writes: "I am getting along splendidly, and the aneurism has completely left me. I sometimes experience a little pain in my left leg when walking fast, otherwise can complain of nothing. Am very fat, my weight being 180 pounds."

A photograph of the groin, received a few weeks later, shows no trace of the aneurism, only a broad vertical scar.

[16] In operations upon the aorta of dogs this posture was found to be of great service.

[17] Journal of Experimental Medicine, 1909, Vol. XI, 373.

April 4, 1912, *three and a quarter years after the operation.* Patient writes: "In reply to your letter of the first, I will try to explain how I am feeling. My left leg is a great deal weaker than my right. I don't limp any. I can't walk very much, as I have pains in my left leg when I do any walking, and in case it gets very cold. My present weight is 180 pounds. I have a splendid appetite, and haven't been ill since my return. All traces of the aneurism have disappeared, and it never worries me the least bit."

29. (Group II.) Beckman, E. H. *Partial occlusion by the Neff clamp*[18] *of the left common iliac artery, presumably for arterio-venous fistula of the femoral artery and vein.* (Communicated to me by Dr. E. H. Beckman, Mayo Clinic, Rochester, Minn., March 6, 1912.)

Dr. Beckman's letter is as follows:

"Patient was a male, 27 years of age, who had been operated upon 11 years previously for osteomyelitis at the lower end of the left femur. The surgeon told him that the artery had been injured at the time of operation. He noticed a marked thrill in the femoral artery. The osteomyelitis wound healed and has given him no further trouble. Patient has had a marked thrill and increased pulsation along the entire femoral artery, and extending above Poupart's ligament, from the time of his operation, but he has been able to continue at work as a paperhanger. He consulted us because, for the past three months, he had had increased pain and tenderness along the course of the femoral artery. We found, upon operative examination, that the femoral artery was dilated to about the size of an aorta throughout its entire length, the dilatation extending above Poupart's ligament. At our *second operation*, performed 11 days after the first, we made an abdominal incision and found that the left common iliac artery looked like the extension of the aorta, being dilated to the same size as the abdominal aorta. The right common iliac artery looked like a small branch coming from the main vessel.

"A Neff clamp was applied to the common iliac artery just below the bifurcation of the aorta, tight enough to partially occlude the former vessel, but not so tight as to arrest the pulsation in the right femoral artery.

"It was thought that the patient also had a small tuberculous abscess at the site of the old osteomyelitis. This presented in the scar of his original operative wound about a week following our first operation and was drained. The patient had several chills, and ran a high temperature for 24 hours following these chills, but otherwise made a good recovery.

"It has now been two months since the clamp was applied, and the patient feels that he is very much improved. He has returned home and will report to us from time to time."

30. (Group II.) Judd, Edward S. *Partial occlusion by the Neff clamp of the right common iliac artery for aneurism of the external iliac. Death.* (Communicated to me by Dr. Edw. S. Judd and Dr. B. F. McGrath, Mayo Clinic, Rochester, Minn., March 25, 1912.) Dr. Judd's letter is as follows:

"Case 61582. Male æt. 28. Examined at the Mayo Clinic, November 27, 1911.

"*Previous History.*—Ten years ago, pneumonia. Six years ago, operation for right inguinal hernia.

"*Subjective Symptoms.*—For the past year the patient has felt a throbbing sensation in the right side of the abdomen, about two inches above the hernial wound. Three weeks ago, and occasionally since then, he has suffered from sharp pleuritic-like pains in the same region on lifting. Otherwise feels well.

"*Objective Signs.*—There is a pulsating mass in the lower abdomen, slightly to the right side. A bruit is heard over the mass. Pulsation of both femoral arteries is absent. The mass pushes into the anterior wall of the rectum, low down. The inguinal glands of both sides are enlarged. The right leg is somewhat swollen. The lower abdominal veins are prominent. A scar resulting from the operation for right inguinal hernia is present. X-ray negative; Wassermann, negative.

"Admitted to St. Mary's Hospital, Dec. 6, 1911, for observation. Temperature and pulse normal to time of operation.

"*Operation.*—Dec. 29, 1911. A low abdominal exploratory incision was made to the left of the mid-line. An aneurismal sac occupied nearly the entire pelvis and bulged over the pelvic brim, thereby obscuring its exact origin, but affording the observation that it arose from the right side of the pelvis.

"A long oblique incision was then made in the right loin, exposing, but not opening, the peritoneum. The latter was reflected, the aorta exposed and the right common iliac artery reached by the guidance of the pulsating wall of the aneurismal sac. The right ureter and the right common iliac vein were isolated, pushed aside, and a Neff occlusion-clamp applied to the common iliac artery about one inch above the aneurism. The clamp was then gradually closed until but a faint pulsation of the tumor was noted.

"*Post-operative Course.*—The pulse was 130 for several hours after the operation, and then varied between this and 162 until the end. Vomiting for the first 24 hours. Severe pain in the right leg. Pulsation of femorals absent. Color of right leg good for two days. Died, Jan. 1, 1912.

"*Autopsy.*—(B. F. McGrath.) An incision to the left of the mid-line, 15 cm. long, is firmly closed with suture. This region is bulging, and there is some ecchymosis about the suture line. In the depth of the same incision is a considerable number of clots, apparently the result of venous oozing. On the right side is a closed oblique incision about 19 cm. long, passing in front of the anterior superior spine of the ilium; this incision extends to, but not through, the peritoneum. The right, lower extremity is very much swollen. On the inner side of the thigh there is venous thrombosis.

"*Thorax.*—Lungs and pleural cavities, nothing noteworthy. The heart is somewhat enlarged, otherwise it presents no changes.

"*Abdomen.*—Liver, moderate degeneration. Kidneys, considerable acute nephritis. A tumor extends from the umbilicus to the left side of the pelvis and down to the right groin. A Neff occlusion-clamp is in position on the right common iliac artery 3 or 4 cm. from the bifurcation of the aorta. About 2.5 cm. below the clamp the artery passes into the tumor, which proves to be an aneurism of the right iliac, its inferior extremity extending to about the beginning of the femoral artery. The left pelvic portion of the tumor consists of a fist-sized fatty mass, rather lightly attached to the aneurismal sac. The aneurism contains dark clotted blood, which is partially organized, and somewhat occludes the lumen.

"Within the artery and directly beneath the aneurism is a valve-like projection from the posterior wall of the vessel. The lateral and anterior edges of the projection are thin and unattached, but in contact with the vascular wall. Its upper surface is somewhat concave, and receives the lower end of the organized blood clot. Its structure is of nearly cartilaginous consistency, and the neighboring lining of the vessel is roughened and firm; sections from this area show principally dense fibrous tissue.

"At the autopsy nothing was found to account for the patient's death. The operation was an extremely difficult one, and required considerable time, and while the patient reacted fairly well, the reaction was not complete. I think there is no possible chance that the clamp could, even partially, have occluded the aorta."

In the opinion of Dr. Judd the operation for hernia, six years ago, was responsible for the aneurism.

[18] Journ. Amer. Med. Asso., 1911, LVII, 700.

TABLE A.—LIGATION OF THE COMMON ILIAC ARTERY.—CASES REPORTED SINCE 1880.

No.	Group.	Operator.	Published.	Date of Operation.	Complications.	Mortality.	Gangrene.	Indication.	Comments.
1	I	O'Grady.	Med. Press and Circular, 1880.	1877, Nov.	Arterio-venous fistula; infection; hemorrage; ligation of femoral and internal iliac arteries.	+	—	Arterio-venous aneurism of the femoral vessels.	Enormously enlarged femoral and external iliac arteries, the latter "resembling a coil of intestine." Death from hemorrhage.
2	II	Richter.	Pacific Med. and Surg. Report, 1880-1.	1881, Feb.	Gangrene before operation.	—	+	Aneurism of external iliac.	Observed only one month after operation.
3	II	Nicoladoni.	Wien. med. Presse, 1882, Nos. 7, 8, and 9 (Aug. Sulzenbacher).	1881, Feb.	Hemorrhage; ligation of external iliac, epigastric and femoral arteries; thrombosis of wounded femoral vein.	+	—	Spurious aneurism of hypogastric and iliac regions.	Spurious aneurism of inguinal region. No reference is made to the circulation of the foot. Death from hemorrhage and prolonged operation (3½ hours) under profound narcosis (chloroform).
4	II	Lange.	New York Med. Jour., 1883.	1883, July.	.....	—	+	Ilio-femoral aneurism.	"Small cutaneous necrosis of the great toe."
5	I	Kümmel.	Verhandl. der deutsch. Gesellsch f. Chir., 1883.	1883, Nov.	Ligation of ext. iliac (twice), femoral (3 times), and finally of the profunda and circumflex arteries.	—	+	Arrest of hemorrhage.	The circulation of the limb remained good until, finally, the ligation of the profunda and circumflex arteries was made. Amputation.
6	II	Schönborn.	Centralblatt f. Chirurgie, 1884 (Stetter).	1883, May.	Infection.	—	+	Aneurism of internal and external iliac arteries.	Gangrene confined to highly infected wound and its neighborhood. No return of pulsation in the aneurism of the internal and external iliac arteries. "Cure." Observed only 6 months.
7	I	Kümmel.	Arch. f. klin. Chir. 1884.	1883, Dec.	Multiple aneurisms; exhausting hemorrhages; gangrene preoperative; ligation of ext. iliac artery.	+	+	Arrest of hemorrhage; multiple aneurisms.	Common iliac ligated to control hemorrhage from ruptured aneurism of calf after lig. of ext. iliac had failed to do so. Interesting to note that lig. of the ext. iliac arrested pulsation in the femoral aneur. for only 2 hrs.
8	I	Gouley.	New York Med. Jour., 1885.	1871, Oct.	Pyæmia.	+	+	Diffuse aneurism of the external iliac.	Circulation in limb not manifestly disturbed and no pain in foot or leg until 18th day. 19th day echymoses about ankle and intense pain in leg.
9	II	Jameson.	Lancet, Lond., 1886.	1885, Apr.	.....	—	—	Aneurism of external iliac.	Aneurism of the right ext. iliac, so large that ligation had to be made through a left-sided incision. "Cure." Observed only 6 months.
10	II	Fluhrer.	New York Med. Record, 1886.	1886, May.	Aneurism of the abdominal aorta; nephritis.	+	—	Aneurism of external iliac.	Death from nephritis.
11	II	Smith.	Trans. Clin. Soc., Lond., 1887.	1885, Oct.	Peritonitis (?); thrombosis of ext. iliac, fem. and profunda veins and of int. iliac, fem. and profunda arteries.	+	+	Ilio-femoral aneurism.	Amputation for gangrene, signs of which appeared in 24 hrs.
12	II	Lucas.	Brit. Med. Jour., 1892 (W. Mitchell Banks).	1888.	.....	—	—	Aneurism of external iliac.	Report incomplete.
13	I	Meyer.	Annals of Surgery, Phila., 1894.	1893, Oct.	Lig. of both of the internal iliac and of external iliac arteries; hemorrhage; infection.	—	+	Secondary hemorrhage.	"Partial gangrene of toes."
14	II	Stevenson.	Lancet, Lond., 1896.	1895, Nov.	.....	—	—	Diffuse aneurism of external iliac and femoral arteries.	For two weeks spontaneous cure of the ilio-femoral aneurism seemed to have taken place. "Cure." Subsequent history not given.
15	II	McBurney.	Annals of Surgery, Phila., 1898.	1897, Dec.	.....	—	—	Aneurism of external iliac.	The aneurism terminated below at Poupart's ligament. At no time were there signs of impairment of circulation. Pains in the leg not mentioned. Brief report. "Cure." Observed only 3 months.
16	II	Bryant.	Annals of Surgery, Phila., 1898.	1893 (?)	.....	+		Aneurism of external iliac.	Cause of death not given. Gangrene not mentioned in the very brief report.
17	II	v. Büngner.	Dissertation, Marburg, 1899, v. Varendorff.	1898, June.	Hemorrhage; excision of sac of the aneurism (ischiadic); aneurism of internal iliac; mitral insufficiency; general arterio-sclerosis; old age (66 years).	+	+	Aneurism of the sciatic and external iliac arteries.	Operation of Philagrius (tying all vessels leading to sac) attempted prior to and completed after the ligation of the common iliac. Blue spots did not appear until the day before death. Confer case 27.
18	I & II	Körte.	Deutsche med. Wchnschr., 1900.	1899, Apr.	Multiple aneurisms (aorta, ext. iliac, femoral, profunda); hemorrhage; organic lesion of heart; thrombosis fem. vein; ligation abdom. aorta.	+	—	Ruptured aneurism of the common iliac.	The bleeding (extravasation) continued after ligation of the common iliac. The aorta was tied to arrest the hemorrhage. Patient died on 37th day after the ligation of the common iliac, and one hour after ligation of the aorta.
19	II	Martin.	Brit. Med. Jour., 1903.	1901, Nov.	.....	—	—	Aneurism of external iliac.	Narrowly escaped gangrene as there were biebs and œdema of the toes. "Cure." Observed only 2½ months.
20	II	Maynard.	Indian Med. Gazette, Calcutta, 1903.	1903, Apr.	Extensive extravasation from rupture of aneurism; diarrhœa.	+	—	Diffuse iliac aneurism.	Circulation of limb not manifestly disturbed although the aneurism must have given off the epigastric, circumflex iliac and profunda arteries.

TABLE A.—Continued.

No.	Group.	Operator	Published.	Date of Operation.	Complications.	Mortality.	Gangren.	Indication.	Comments.
21	I	Czerny.	Deutsche Ztschr. f. Chir., 1904 (Dreist).	1897, Feb.	Tuberculosis.	+	—	Slight hemorrhage in course of operation.	Collateral circulation chiefly by internal iliac arteries. The common iliac was tied for wound of a small anomalous branch of this artery occasioned in course of operation. Loss of blood, insignificant.
22		Küster.	Ibidem.	1898, Jan.	Ligation of both femoral and of right ext. iliac arteries.	—	—	Elephantiasis.	Ligation of left common iliac for cure of elephantiasis. Negative result.
23	I	Trendelenburg.	Ibidem.	1898, Oct.	Exsanguinating hemorrhage from accidental rupture of sac during the operation; general arterio-sclerosis.	+	—	Hemorrhage from dissecting aneurism of common iliac.	Death from hemorrhage.
24	II	Christel.	Ibidem.	1901, Mar.	Profuse hemorrhage during op.; extravasation of blood and infection; lig. ext. iliac and epigastric arts.	—	+	Spurious aneurism of femoral.	Aneurism of fem. art. and probably of the profunda. The ext. iliac ligated above epigastric and probably above circumflex iliac also. Amputation. Cure. Observed 2 years.
25	I	Clark.	Brit. Med. Jour., 1905.	1899, May	Repeated, severe hemorrhages to point of collapse; infection.	—	—	Hemorrhage.	One of the four cases in Group I of recovery after ligation of common iliac for hemorrhage, and the only case in this group (if we place Dequise's in Group II) recovered without gangrene. "Cure." Observed 9 months.
26	II	Cranwell.	Revista de la Sociedad Médica Argentina, 1906.	1904, Feb.	General arterio-sclerosis; great œdema of thigh and leg.	+	+	Aneurism of external iliac and femoral arteries.	Ilio-femoral aneurism. Profunda as well as epigastric and circumflex iliac arteries probably given off from the sac. Gangrene from toes to calf.
27	II	Gillette.	Annals of Surgery, Phila., 1908.	1906, Apr.	Lig. internal and external iliac arts.; sac opened and tied off; amputation for gangrene.	—	+	Aneurism of sciatic artery.	Confer case 17. Amputation.
28	II	Halsted.	Not hitherto reported.	1909, Jan.	.....	—	—	Ilio-femoral aneurism.	Aneurism cured. Observed 3½ years.
29	II	Beckman.	Communicated by letter, Mar. 6, 1912.	1912, Jan.	Enormously dilated femoral, ext. iliac and common iliac arteries.	—	—	Arterio-venous fistula of femoral vessels?	Employed Neff clamp, partially occluding the common iliac artery. Probably an arterio-venous fistula, caused by an operation for osteomyelitis of femur.
30	II	Judd.	Communicated by letter, Mar. 25, 1912.	1911, Dec.	.....	+	—	Aneurism of ext. iliac artery.	Employed Neff clamp, partially occluding the common iliac artery. Aneurism believed to have resulted from an operation for hernia performed six years previously.

TABLE B.—GANGRENE.

No.	Group.	Operator.	Additional factors in the production of gangrene.	Time of its appearance.	Indication for operation.	Comments.
1	II	Richter.	Huge aneurism; limb enormously swollen; patient very anemic.	Before operation. Extended to knee in 2 days.	Aneurism of external iliac.	Aneurism so large as to compel incision on opposite side of abdomen. Extraperitoneal operation.
2	II	Lange.	Aneurism ext. iliac and femoral arteries; leg cool, blueish and pulseless before operation.	.....	Ilio-femoral aneurism.	Cutaneous gangrene of great toe only. Due perhaps to the situation of the aneurism.
3	I	Kümmel.	Hemorrhage; ligation of ext. iliac (twice), of fem. (3 times), of epigastric, circumflex iliac, profunda, int. circumflex, ext. circumflex and comm. iliac arts.	11th day.	Hemorrhage.	There were no signs of gangrene prior to the ligation of the profunda and circumflex vessels, which were tied ten days after the ligation of the common iliac.
4	II	Schönborn.	Highly infected wound.	.....	Aneurism of external and internal iliac arteries.	Gangrene confined to the wound and its neighborhood.
5	I	Kümmel.	Multiple aneurisms; gangrene from rupture of aneurism in calf; hemorrhage.	Before operation.	Hemorrhage.	Desperate case.
6	II	Gouley.	Local and general infection.	19th day.	Ilio-femoral aneurism.	Published in 1885, but operated upon in 1871.
7	II	Smith.	Infection; thrombosis of ext. iliac, fem. and profunda veins, and of int. iliac, fem. and profunda arteries.	2nd day.	Fusiform ilio-femoral aneurism.	.....
8	I	Meyer.	Ligation of both int. iliac arteries; infection; hemorrhage.	.....	Hemorrhage.	Partial gangrene of toes.
9	II	v. Büngner.	Arterio-sclerosis; mitral systolic murmur; hemorrhage; excision of sac; exhaustion.	5th day.	Aneurism of sciatic artery.	Signs of gangrene (blue spots) appeared one day before death.
10	II	Christel.	Profuse hemorrhage during operation; ligation of ext. iliac and epigastric arteries; extravasation of blood; infection; enormously swollen thigh.	"After a time."	Aneurism of femoral and probably of profunda artery.	The ext. iliac was ligated above and below the epigastric and circumflex iliac arteries.
11	II	Cranwell.	General arterio-sclerosis; thigh and leg œdematous; patient in bad general condition. Compression by the aneurism of the internal iliac art.	3rd day.	Aneurism of external iliac and femoral arteries.	The internal iliac artery seems to have been greatly compressed by the aneurism of the external iliac. This may account, in part, for the gangrene. The aneurism involved the fem. as well as the int. iliac arts. and was of the fusiform variety.
12	II	Gillette.	Ligation of internal and external iliac arts.; excision of sac (ischiadic region).	3rd day.	Aneurism of sciatic artery.	The two cases of ligation of the common iliac artery in which an aneurism in the gluteal region was excised both had gangrene (cf. case of v. Büngner).

TABLE C.—FUNCTION IN CASES RECOVERED WITHOUT GANGRENE.

No.	Group.	Operator.	Date.	Time observed.	Function.
1	II	Mott.	1827	3½ months.	Patient states "leg is as strong as the other."
2	II	Salomon.	1837	10 months.	"Psoitis Rheumatica" (psoas abscess).
3	I	Deguise.	1840	5 weeks.	.....
4	II	Peace.	1842	14 months.	Able to work. Died of recurrence of aneurism (hemorrhage).
5	II	Hey.	1843	6 weeks.	.....
6	II	Garviso.	1843	.....	.....
7	II	Luzenberg.	1846	.....	No note as to function or time observed.
8	II	Bickersteth.	1862	37 days.	.....
9	II	Cock.	1863	'A few months."	"No untoward symptoms."
10	II	Jameson.	1885	6 months.	Flexed knee and hip.
11	II	Lucas.	1888	.....	.....
12	II	Stevenson.	1895	5 weeks.	.....
13	II	McBurney.	1897	3 months.	Weakness in left leg.
14	II	Martin.	1897	2½ months.	Could walk about slowly.
15	II	Küster.	1897	.....	Elephantiasis (operation for).
16	I	Clark.	1899	9 months.	Resumed work as porter at railway station.
17	II	Halsted.	1900	3¼ years.	Can walk only a short distance. Pain.
18	II	Beckman.	1912	2 months.	Arterio-venous fistula (operation for).

TABLE D.—THE MORTALITY AND ITS CAUSES.

No.	Group.	Operator.	Survived Operation.	Cause of Death.	Indication.	Comments.
1	I	O'Grady.	7 hours.	Previous operative procedures; hemorrhage; infection.	Arterio-venous aneurism of femoral vessels.	Operated upon in 1879.
2	II	Nicoladoni.	45 hours.	Prolonged operation; hemorrhage.	Spurious aneurism of right hypogastric and iliac regions.	Death might perhaps have been avoided by primary compression of the common iliac.
3	I	Kümmel.	12 hours.	Preoperative gangrene; hemorrhage.	Arrest of hemorrhage from one of a number of aneurisms.	Patient in desperate condition before operation.
4	I	Gouley.	21 days.	Pyæmia.	Diffuse aneurism of the ext. iliac.	Operation in 1871.
5	II	Fluhrer.	7 days.	Nephritis.	Aneurism of the external iliac.	The increase in blood-pressure may have lighted up a chronic nephritis.
6	II	Smith.	11 days.	Peritonitis (?); thrombosis; gangrene.	Ilio-femoral aneurism.	Ligation of the common iliac not alone responsible for the result.
7	II	Bryant.	3 days.	.....	Aneurism of the external iliac.	Very brief report. Cause of death not given.
8	II	v. Büngner.	5 days.	Hemorrhage; gangrene.	Aneurism of the sciatic artery.	The hemorrhage and gangrene might perhaps have been avoided by preliminary occlusion of the common iliac.
9	I & II	Körte.	37 days.	Hemorrhage; ligation of abdom. aorta 37 days after lig. of common iliac.	Ruptured aneurism of the common iliac.	Death occured one hour after ligation of the aorta.
10	II	Maynard.	8 days.	Extravasation of blood; preoperative gangrene of scrotum; diarrhœa.	Diffuse iliac aneurism.	Death not attributable solely to ligation of the common iliac.
11	I	Czerny.	5 months.	Miliary tuberculosis.	Slight hemorrhage in course of operation.	The ligation of the common iliac not responsible for the death five months later.
12	I	Trendelenburg.	3 hours.	Hemorrhage.	Dissecting aneurism of common iliac.	.....
13	II	Cranwell.	36 days.	Arterio-sclerosis; sacral decubitus; gangrene; amputation.	Aneurism of ext. iliac and femoral arteries.	The amputation wound showed no tendency to heal. Death too long after operation to be attributed to ligation of common iliac.
14	II	Judd.	2 days.	Patient did not rally from operation of 3 hours' duration.	Aneurism of external iliac.	Difficult and prolonged extraperitoneal ligation of the common iliac.

GANGRENE.

In the thirty-two cases operated upon prior to 1860, reported by Stephen Smith, gangrene of the leg or foot occurred in five or 15.6 per cent. But on study of the reports of these cases, I find that, probably, in only a single instance might the gangrene be attributed to ligation of the common iliac. The cases are as follows:

1. Group I. (No. 7, Smith.) G. W. F. Unde, Braunschweig. (Deutsche Klinik, No. 16, April, 1853.)

2. Group II. (No. 4, Smith.) M. Salomon, St. Petersburg. (Zeitschrift f. d. Gesammte Medicin, Bd. 12, Heft 3, 1839.)

3. Group II. (No. 5, Smith.) James Syme. (Edinburgh Medical and Surgical Journal, October, 1838.)

4. Group II. (No. 11, Smith.) A. J. Wedderburn, New Orleans. (New Orleans Medical and Surgical Journal, May, 1852.)

5. Group III. (No. 4, Smith.) C. Th. Meier, New York. (New York American Medical Gazette, May, 1859.)

Ad. 1. *Aneurism of the left gluteal artery; rupture of the internal iliac in attempt to ligate it; ligature of common iliac artery. Death on fourth day after operation.*

Autopsy.—"Internal iliac ruptured; indications of peritonitis, leg œdematous, calf red, showing signs of approaching gangrene."

In this case gangrene did not actually develop, notwithstanding the fact that the patient died on the fourth day. There were merely indications, and at the autopsy, of *approaching* gangrene. Had the patient lived, even these "signs" might not have manifested themselves. Note that the internal iliac artery was ruptured and not ligated and that five pounds of blood were lost. At autopsy the tissues about the sac were infiltrated with blood, and many pockets of blood were found in the muscles. Even, therefore, had gangrene developed during life, it would not have been attributable solely to the ligation of the common iliac.

Ad. 2. *Aneurism of the left external iliac artery; ligature of the common iliac. Recovery.*

The aneurism was traumatic, caused by the kick of a horse. It extended from four fingers' breadth above to the same distance below Poupart's ligament; in the region, therefore, in which important anastomotic vessels are located. The pulsation ceased and the tumor rapidly diminished in size after the ligation of the common iliac, and the limb which became cool at first regained its natural warmth. In this patient, nothing more than gangrenous eschars appeared on the foot which subsequently healed. It is to be noted that the situation of the aneurism in this case was approximately the same as in Wedderburn's (4), but in the former it may have been of the sacculated variety.[19]

The case is reported in great detail by Salomon in the quaint little Zeitschrift für die Gesammte Medicin, sometimes referred to as Oppenheim's Zeitschrift.

The patient died ten months after the operation from "psoitis rheumatica"—a suppurative inflammation in the course of the psoas muscle on the affected side.

Very instructive are the findings at autopsy relative to the collateral circulation after ligation of the common iliac. Salomon injected the descending aorta with a wax mass.

The injected wax mass had passed into both lower extremities. The arteria iliac communis sinistra had been ligated about one-half inch below the bifurcation of the aorta abdominalis, as was proved by the obliterated and narrowed portion of the common iliac; moreover, throughout its entire course, this artery was converted into a ligamentous substance; into the arteria iliaca externa sinistra some of the wax mass had been forced by way of the arteria hypogastrica sinistra (left internal iliac). The collateral circulation above the ligature had been carried on by means of the greatly dilated lowest arteria lumbalis (ileo-lumbar) whose branches communicated with those of the arteria circumflexa ilei sinistra. The left lower extremity received its arterial blood principally through the branches of the arteria hypogastrica sinistra, which communicated freely with those of the right side, so that the injected mass by way of these had penetrated into the vessels of the left thigh; the arteria femoralis was filled with wax to about two inches below Poupart's ligament. The arteria iliaca communis, iliaca externa and hypogastrica of the right side were greatly dilated. In the left thigh the branches of the obturator and ischiadic arteries were particularly enlarged.

These observations of Salomon's are instructive in that they demonstrate the importance of the obturator and sciatic arteries, of the anastomoses between the internal iliac arteries of the two sides, and between the circumflex iliac and ileo-lumbar arteries of the same side. No mention is made of the condition of the deep epigastric artery.

Ad. 3. *Aneurism of the right external iliac artery. Mortification of the limb and, subsequently, ligation of the common iliac artery.*

Here the gangrene preceded the operation and almost necessarily increased in extent after it.

Ad. 4. *Aneurism of the left femoral and external iliac artery. Ligation of the common iliac.*

Severe hemorrhage during the operation and death on the fourth day. Gangrene below the knee on the second day; extended to the hip on the fourth day. Pulsation ceased in the aneurism.

This was an aneurism which, perhaps, gave off all the important, anastomotic branches—the epigastric, circumflex iliac, profunda, internal and external circumflex arteries—above and below Poupart's ligament.

The great loss of blood during the operation may have enfeebled the patient to an extreme degree and predisposed to the gangrene, which was too great in extent to be conceived of as due solely to occlusion of the common iliac.

The original account of this case which was reported under the heading "Editorial"—"City Intelligence," is meager, and was, presumably, not written by the operator, Wedderburn. As to the findings at autopsy, nothing is said of the condition of the branches of the external iliac and femoral arteries nor is

[19] From Salomon's account of the post-mortem examination, "Die Pulsader-geschwulst hatte ihren Ursprung gleich oberhalb des Ligamentum Poupartii genommen und sich auf-und abwarts verbreitet."

the precise extent of the aneurism given. In the account of the operation, it is mentioned that the aneurism extended to within one or two inches of the bifurcation of the primitive iliac artery.

Probably there was extensive thrombosis of veins and arteries; and, as I have said, it is likely that all the arteries important for the anastomotic circulation opened into the aneurismal sac and became obliterated after the ligation. It is an established fact that the life of the limb may be imperiled by the cure, per se, of an aneurism.

Ad. 5. Patient, æt. 59. *Immense osteo-aneurism of the pelvis, gluteal region and femur. Ligation of common iliac.*

Second day, discoloration of the *wound and thigh;* third day, increasing discoloration; fourth day, wound dark and neighboring parts inflamed; toes and sole of foot black; gangrene continued to the hip. Gangrene appeared first about the wound. At autopsy, peritonitis was found. In this case, it would not be justifiable to assume that the ligation of the common iliac artery was alone responsible for the gangrene.

Only in Case 2, therefore, might it be reasonably supposed that the ligation of the artery was the sole cause of the gangrene; and in this patient there were merely eschars which healed without surgical interference. It is to be borne in mind that the wounds in all of these cases were infected.

To Stephen Smith's 32 cases (from 1827-1860) Kummel[20] adds 15 from the septic era.

To Group 1, 3 cases, from 1863-1865 (Nos. 13, 14 and 15). In none of these was there gangrene. In Case No. 14 amputatio femoris was done before the ligation of the common iliac and hence it is not pertinent to the subject under consideration.

To Group II, 12 cases,[21] from 1861-1875 (Nos. 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46). In only two of these (Cases 39 and 41) is mention made of gangrene.

Ad. 39. Hargrave.[22] *Arterio-venous aneurism of the external iliac vessels. Ligature of the common iliac artery.*

A large pulsating tumor of the left iliac fossa which had been treated in vain by digital and instrumental compression. On the 29th day after operation, dry gangrene of the foot began. On the 45th day all the toes were mummified. The gangrene extended, and the extremity became œdematous, as high as the hip joint. On the 67th day large pelvic abscesses were opened on both sides, and great quantities of foul-smelling pus evacuated. Arterial hemorrhage from the right abscess on the 71st day. On the 73d day recurrence of the hemorrhage and death.

Note that the aneurism was of the arterio-venous variety and probably included the epigastric and circumflex and iliac vessels, that there was very extensive suppuration in the pelvis, and that gangrene did not begin until the 29th day.

Ad. 41. Maundner.[23] *Ligation of the common iliac artery for aneurism of the right external iliac. Death on the 60th day from gangrene of the corresponding extremity.*

The common iliac vein was obliterated.

[20] Archiv. f. klin. Chirurgie, 1884, p. 66.

[21] Consult original article for Cases 57, 58, 59, 60, 61, 62 in Kümmel's appendix.

[22] Dublin Med. Press, 1865, Vol. II.

[23] Med. Times & Gazette, Oct., 1867 (Maundner).

From the years between 1875 and 1884, Kümmel reports only 4 cases (all antiseptically treated) of ligation of the common iliac artery, two being his own. Gangrene occurred in three (75 per cent) of these cases.

1. Group I. No. 16, Kümmel. (Archiv f. klinische Chirurgie, 1884, p. 67.)

2. Group II. No. 47, C. M. Richter. (Pacific Medical and Surgical Journal, 1881, p. 505.)

3. Group II. No. 48, Nicoladoni. (Sulzenbacher, Wiener med. Presse, 1882, Nos. 7-9.)

4. Group II. No. 56, Kümmel. (Loc. cit.)

Ad. 1. *Hemorrhage from erosion of the femoral artery, following operation for bubos, and diphtheritic infection of the wound. The femoral artery was ligated three times, the external iliac artery twice, and ultimately the profunda and circumflex arteries. Gangrene of the leg. Amputation. Recovery.*

Not only were all of the above vessels ligated, in addition to the common iliac, but the patient's vitality had been greatly lowered by repeated and excessive hemorrhages. Gangrene beginning in the foot on the day after the ligation of the profunda and the third ligation of the femoral (12 days after the ligation of the common iliac) had extended more than half way up the leg on the third day. In this case, certainly, the ligation of the common iliac artery was not alone responsible for the gangrene.

Ad. 2. *Aneurism of the external iliac. Ligature of the common iliac. Gangrene of the leg. Recovery.*

The aneurism, as large as the head of a child, was non-pulsating. The leg of the affected side was twice the size of the other. Ligation of the common iliac was undertaken because gangrene was beginning and the aneurism was increasing in size. Note that the gangrene antedated the operation.

Ad. 4. *Aneurism of the inguinal region and of the calf of the leg. Bursting of the latter aneurism. Ligation of the external iliac. Subsequent hemorrhage. Ligation of the common iliac. Death in 12 hours.*

Gangrene of the calf of the leg in the infiltrated tissues along the ruptured aneurism, occurred before the ligation of the common iliac artery. In not one of the three cases, therefore, was uncomplicated ligation of the common iliac artery responsible for the gangrene.

For the nine years from 1884, the date of Kümmel's paper, to 1903, the year of his own communication, Dreist was able to add only 6 cases to Groups I and II, none to Group III. One of these (Trendelenburg's) died of hemorrhage three hours after the operation. In two (Christel's and v. Varendorrf's) of the remaining five gangrene occurred (40 per cent), but it was not due, primarily, to ligation of the common iliac in either case.

1. Group I. (No. 3, Christel, 1901, loc. cit., p. 6.)

2. Group II. (No. 5, v. Varendorrf, 1898. Dissertation, Marburg, 1899.)

Ad. 1. *Spurious aneurism, presumably of the femoral artery, caused by splinter of iron. Ligation of the left, common iliac artery. Gangrene of leg. Recovery.*

Greatly emaciated patient; pulse 126-130; temperature 34.7°. Left thigh tremendously swollen, the tumefaction extending from knee to navel. In the course of the operation, the external iliac was twice ligated. The epigastric artery which was given off from the external iliac between the two ligatures was also ligated. Finally a ligature was placed on the common iliac artery; as further peril to the circulation of the leg there was deep suppuration of the œdematous thigh. To attribute the gangrene in this case to ligation of the common iliac would be unreasonable.

Ad. 2. *Injuries and aneurisms of the gluteal and sciatic arteries. Ligation of the left common iliac artery. Gangrene. Death.*

Woman, æt. 66. Pulsating tumor as large as a child's head in the left ischiadic region. Attempt made by the operator to ligate all the vessels contributing to the aneurism and to extirpate the sac (Philagrius). Accidental tearing of the sac. Ligation of the internal iliac artery which proved to be the seat of a fusiform aneurism. Immediately upon discovery of this, ligation of the common iliac artery which, in turn, presented several small, fusiform dilatations of its calcified wall. Extirpation of the sac and of two-thirds of the imbedded sciatic nerve. Tamponade. On the second day, gangrene of the entire leg. On the fourth day, death. The ligation of the common iliac was, accordingly, only one of the several factors which contributed to the gangrene.

In Kümmel's collection (1884), only four cases in Groups I and II are from antiseptic times (Nos. 2, 3, 5, and 7 of my Table A). As I have said, in three of these (two of them his own) gangrene occurred, but in two of the three the gangrene had manifested itself before the ligation of the common iliac. The number of his cases is too small for statistical purposes.

For Groups I and II in the antiseptic era, Dreist, 1903 (loc. cit.), collected ten cases—five for each group. Five of these had gangrene. Hence he concludes that "the chief danger" from ligation of the common iliac artery "is still today the gangrene which results in its consequence."

Gillette in 1908 (loc. cit.) could add only one case (Martin's) beside his own to the collection made by Dreist in 1903. He makes the statement that "gangrene of the leg has occurred in the last twenty-one cases seven times, or in 33⅓ per cent."

Matas, in a masterly article of 333 pages on the Surgery of the Vascular System (Keen's Surgery, 1909, Vol. V, p. 337), writing of ligation of the common iliac artery, says that "In the 21 operations done since 1880, presumably with antiseptic precautions, gangrene occurred 7 times, or in 33.33 per cent."

Gillette and Matas must have included in their calculations ligations of the common iliac artery performed with objects in view other than the arrest of hemorrhage and the cure of aneurism, cases complicated, some of them, by desperate operations such as disarticulatio inter-ilio-abdominalis, and which belong to the Groups III and IV of Stephen Smith.

In the thirty cases (Groups I and II) of ligation of the common iliac artery published since 1880, and collected in this paper, gangrene has occurred twelve times, or in 40 per cent (vid. Table B).

Table B has been arranged to enable the reader to see at a glance[21] the factors other than the ligation of the common iliac artery which have been instrumental in the production of the gangrene.

Two of the twelve cases (Nos. 1 and 5), can be excluded because the gangrene had manifested itself before the ligation of the common iliac was undertaken.

In one (No. 9) signs of gangrene ("blue spots") appeared on the fourth day when the patient, aged and exsanguinated, was almost moribund. She died the following day. In this case, the sac of a sciatic aneurism had been excised.

In Case 4 the gangrene, which consisted in the casting off of sloughs, was confined to the operative wound and its environs, and was due to an intense local infection. There was no gangrene of the foot or leg.

Perhaps the most striking instance in the literature of the extent to which the main arteries may be tied without manifest disturbance of the circulation of the limb is furnished by a case of Kümmel's (Table B, No. 3). In this patient, who was exsanguinated by terrific hemorrhage almost to the point of death, there were ligated the common iliac, the deep epigastric, and the circumflex iliac, the external iliac twice, and the femoral three times, and all without the production of signs of gangrene. It was not until eleven days after the ligation of the common iliac and when three vessels in the neighborhood of the profunda femoris had been tied, that gangrene supervened.

Gouley's case, No. 6, although not published until 1885, was operated upon in 1871, in the highly septic times. The patient died of infection on the 21st day, the gangrene manifesting itself not until 48 hours before death.

In No. 7, the case of Thos. Smith, there were, as complications resulting from infection, thrombosis of the external iliac, femoral and profunda veins, and of the internal iliac, femoral and profunda arteries. The aneurism involved the femoral as well as the external iliac artery and was of the fusiform variety. I should think that, in this locality, ligation of the common iliac for the obliteration of a fusiform aneurism might be more likely to be followed by gangrene than if performed for the cure of a sacculated aneurism, because from the fusiform variety, the deep epigastric, the circumflex iliac and the profunda arteries are given off, which they may not be in the case of the sacculated or spurious varieties (vid. also Cranwell's case, No. 11).

In Meyer's case, No. 8 (ligation of the external and both of the internal iliac arteries), infection and hemorrhage should be regarded as factors contributing to the gangrene which involved only the toes, and these only in part.

No. 10, Christel. In this instance it is clear that the complications must have been largely influential in the production of gangrene. Profuse hemorrhage occurred in the course of the operation. The external iliac artery was ligated both above and below the origin of the deep epigastric and circumflex iliac arteries, the latter of these being independently tied. There

[21] The reader is referred also to the abstracts which I have made of these cases.

was extensive extravasation of blood, the thigh was enormously swollen and the tissues infected. The aneurism was of the femoral artery and probably involved the profunda.

No. 12. Gillette ligated the internal and external iliac arteries, as well as the parent stem and excised an aneurism of the sciatic.

In ten of the twelve cases, therefore, it would be unfair, indeed absurd, to attribute the gangrene to the ligation of the common iliac artery.

The cases of Lange and Cranwell remain to be considered. In one of these, Lange's (No. 2), there seems to have been no complication and we must assign as cause for the gangrene the ligation of the common iliac artery. The gangrene was, however, very trivial, involving, as it did, only the skin of the great toe.

The situation of the aneurism may have been a factor in the determination of the gangrene. It involved the femoral as well as the external iliac arteries.

Cranwell's case (No. 11) is the only one known to me, operated upon in antiseptic times,[25] in which *significant* gangrene has occurred after ligation of the common iliac artery not complicated by other factors contributing to the serious disturbance of the circulation in the limb. The publication is in Spanish. The case seems to be fully reported and well presented and I have no reason for believing that there is anything to be read between the lines. As stated in the text and shown in a semidiagrammatic illustration, the internal iliac artery was compressed, possibly occluded, by the aneurism which involved not only the entire external iliac but also the femoral artery. It was noted before operation that the thigh and leg were œdematous, that there was general arteriosclerosis and that the patient's condition was bad. The aneurism had existed for fifteen and perhaps for thirty years. Attacks of cramps in the limb of the affected side, severe enough to prevent locomotion, had been present for thirty years (conf. abstract).

The case is a remarkable one, but must nevertheless be accepted for the present as furnishing an instance of the production of gangrene from ligation of the common iliac artery.

Granting that in the case of Lange and Cranwell the ligation of the artery was solely responsible for the gangrene, we have only two such cases in the thirty of my collection, a percentage of six and six tenths.

If it should appear later that Cranwell's case might, for unascertained reasons, be excluded, the percentage would, of course, be three and three tenths, and the sum total of gangrene the cutaneous necrosis of one toe.

THE ANASTOMOTIC CIRCULATION.

It would involve much labor to determine what the actual danger of gangrene is from ligation of the various arteries. The factors contributing to the gangrene in each reported case would have to be duly considered.

The percentages have been computed by many authors and although between the minimum and maximum estimates there may be great variation, there seems to be little doubt as to the relative frequency with which gangrene has manifested itself after ligation of one as compared with another of the principal vessels of the extremities.

There is abundant evidence in support of the view that, in a general way, the larger the artery, or the nearer it is to the heart, the less the impairment of the circulation attending its ligation. The subclavian, for example, may be tied quite without fear of gangrene, whereas from ligation of the axillary artery the circulation of the extremity is somewhat endangered, but not so much as from ligation of the brachial.

Peripheral gangrene has not been observed in consequence of ligation of the aorta. It may occur after ligation of the common iliac, has occurred much more frequently after ligation of the external iliac, and has followed ligation of the popliteal artery in a considerable percentage of the cases.

Kümmel, offering the generally accepted explanation of the imperfect law, writes:

> "It seems, naturally within certain limits, that the nearer the ligated vessel is to the central organ of the circulation, the easier it is for the collateral routes, *by means of the increased pressure from the heart*, to develop; this certainly seems to hold true of the vessel which we are considering (common iliac).
>
> "Astonishing as it may seem, it nevertheless appears to be a fact, as already stated, that the ligation of the common iliac less endangers the vitality of the lower extremity, and makes easier the establishment of the collateral circulation than does the ligation of a peripheral vessel, for example, the external iliac.
>
> "I do not hesitate, therefore, in the case of aneurisms of the external iliac and high femoral arteries, to express a preference for the ligation of the common iliac, even when ligation of the external iliac is possible, for, thereby, the definite cure of the aneurism seems to be more certain of accomplishment, and the life of the limb is less endangered."

Surely one would not, with the hope of diminishing the danger of gangrene and in order to produce a condition equivalent to the tying off of the parent trunk, ligate the internal iliac after ligation of the external iliac had been made. Ligation of the common iliac is not, of course, equivalent to ligation of the external and internal iliacs, unless one or the other of these branches is obturated at a lower point, as by aneurism; or unless they are ligated so close to the parent stem that no blood can pass from one to the other over the spur of bifurcation.

May it not be, inasmuch as in the cure (spontaneous or operative), per se, of certain aneurisms there lies danger to the life of the limb, that the particular situation of the aneurism may be an important factor in the determination of gangrene, and that, for example, the aneurisms for the cure of which ligation of the common iliac has generally been done are less likely to impair the vitality of the limb than are the aneurisms for which ligation of the external iliac has usually been undertaken?

The obliteration by any method of ilio-femoral aneurisms giving off the deep epigastric, circumflex iliac and profunda arteries might well be followed by impairment more or less serious of the circulation of the foot and leg, whereas the cure of an aneurism of the external iliac artery terminating above

[25] Antiseptic precautions were presumably observed.

the origin of one or more of these branches should not be attended with equal consequence.

As shown by Porta,[26] Pirogoff[27] and Kast,[28] and as observed by myself, the epigastric and circumflex arteries are of great importance in the establishment of the collateral circulation after ligation of the abdominal aorta. Salomon and Czerny have emphasized the great dilatation of the internal iliac and its branches after ligation of the common iliac artery. The anastomoses between the two internal iliacs are very free and numerous, and through these the blood reaches the femoral artery chiefly by way of the profunda. I have already called attention to the interesting fact that in Kümmel's case (Table A, No. 5) the circulation of the limb remained good until the profunda and its circumflex branches were occluded, although the common iliac, the external iliac (twice) and the femoral (three times) had previously been ligated.

We find additional demonstration of the importance of the anastomoses between the internal iliac arteries of the two sides after ligation of the common iliac in the two cases of our collection in which the sac of an aneurism in the gluteal region was excised. In both of these gangrene supervened.

Ligation in continuity should rarely be resorted to, for when branches are given off between the sac and the ligature, the circulation of the limb is more impaired than by ligation, tangential to the sac, and for the reason that the artery becomes obstructed in two places, at the site of the ligation and of the aneurism.

Partial Occlusion.

It may be asked, "What is to be gained by partial occlusion of the common iliac, if its object is the cure of the aneurism and obliteration of the arteries given off from the sac?" The reply is that with the partial occlusion of the parent trunk, the direct circulation through the internal iliac is not obturated. I believe, however, that the common iliac artery, partially occluded by a metal band, will ultimately become completely obstructed. My experiments on the aorta of dogs afford ample proof for the belief that even a small direct stream is of great value. Thus a considerable mortality attended the complete occlusion of the aorta in dogs, whereas with partial obstruction by the metal band, death rarely occurred. In man, I have in four instances had the opportunity to observe the effect of partial occlusion of the aorta. In no case were disquieting symptoms manifested, although in one patient the femoral pulse was obliterated by the partial obstruction and reappeared only on agitation or exertion.

These results are in striking contrast with those consequent to ligation of the aorta.

A fusiform aneurism of the aorta was so greatly reduced in size by partial occlusion with the metal band that relief from the symptoms was obtained and the aneurism was believed to have been almost cured. But the patient died in six weeks from a sudden hemorrhage due probably to atrophy of the diseased arterial wall and the cutting through of the band.

A band was applied one and a half years ago to a greatly dilated vein proximal to an arterio-venous fistula, which had been painstakingly explored in the hope that the opening might be closed without obliteration of either the vein or the artery. The patient, an old man, with advanced arteriosclerosis, has recently sent me word by his physician, Dr. Fox of Greenville, Tenn., that his condition is greatly improved by the operation.

The partially occluding metal band has already been applied by me in man to all of the principal arteries, to the aorta four times; innominate, once; subclavian, twice; carotid, many times; femoral, three times; popliteal, once; and without accident except in the aortic case, referred to above, which will probably be reported later by the eminent director of a European clinic.

The partial occlusion, with a metal band, of an artery, other than the aorta must, ultimately, it seems to me, bring about total obliteration of its lumen. Occasionally the aorta becomes converted, under the band, into a solid fibrous cord. This has occurred, thus far only in cases in which the vessel was almost completely occluded.

But I have been constantly apprehensive lest, in the case of the aorta, the wall might ultimately give way, atrophying slowly but surely, under the pressure exerted by the constricting metal. As our laboratory for experimental surgery is closed during the summer, it has not been feasible for me to observe the ultimate effect of a partially occluding band upon the aorta for a period longer than 7½ months. In many instances, however, I have noted a thinning of the aortic wall under the band, and in some the attenuation has been so great that I could foresee no outcome other than perforation of the wall of the artery.

In total occlusion of the artery the band in three animals was found embedded in a strong, fibrous capsule continuous above and below with the arterial wall. In this manner hemorrhage was prevented, notwithstanding the fact that the aorta as well as the fibrous capsule were patulous throughout. The band was, however, so snugly embraced by the surrounding cylinder of fibrous tissue that little, if any blood could pass between the two.

But in the cases of partial occlusion of the aorta no such fibrous capsule was forming, and for the reason, undoubtedly, that there was no occasion for its formation. The occasion would, probably, come sooner or later, and perhaps, altogether without warning, or too quickly for efficient response from the surrounding tissues.

Hence, if a partially obstructing metal band is applied to the aorta, it would seem that some further operative procedure must usually be contemplated, even if the aneurism should be apparently cured. It might consist in partial occlusion of both common iliac arteries (this might be done as part of the original operation) and later of complete occlusion of the aorta, by bands or possibly ligatures, both above and below the

[26] Della Alterazioni Patologiche Della Arterie Per La Ligatura E La Torsione. Esperienze Ed Osservazioni Di Liugi Porta. Milano, 1845.

[27] Pirogoff. Journal der Chirurgie und Augenheilkunde. v. Walter und v. Gräfe, 1838, XXVII.

[28] Kast, Deutsche Zeitsch. f. Chirurgie, XII, 405.

original band. In the cases in which it may be ventured to close the aorta almost completely, the fibrous-cord formation might be hoped for, and the omission of a second operation justified.

We noted further in our experiments that the aorta of dogs after having been totally occluded by silk ligature may again become patulous. This restoration of lumen is brought about by the cutting through of the ligature, and has usually been accompanied by the formation of a diaphragm of greater or less extent.[a] Similar observations have been made upon the human subject after the ligation of large arteries (innominate, subclavian, femoral).

Acting on this hint given by nature, I tested, last winter, on thirteen dogs, the effect of partially occluding ligatures of fine silk, placed one above the other on the aorta, hoping that we might obtain a series of superimposed diaphragms which, if sufficient in number and extent, might sufficiently obturate the aorta to bring about the cure of an aneurism.

But these partially occluding ligatures of very fine silk, not only produced no diaphragms, but gave rise in two of the thirteen dogs to fatal hemorrhage.

From the totally occluding, crushing, coarse, silk ligature in dogs, I have seen no case of hemorrhage. Was, then, the fineness of the silk or the incompleteness of the occlusion responsible for the bleeding? Or were both concerned in bringing about the result?

We are now testing the behavior of organizable tissues used as bands to constrict the aorta. Spiral strips and cuffs cut from the fresh aorta of one dog are wound about the aorta of others. I should fear, however, that tissues capable of organization under such circumstances would be stretched * by the dilating force of the aortic pulse. Should they serve their purpose for a time, enough might possibly be accomplished to enable one at a subsequent operation to produce, if necessary, complete occlusion in some other way.

Lateral excision of a piece of the aortic wall and suture of the defect might easily be accomplished experimentally, but in the presence of aneurism this would, I fear, rarely be feasible; for the aneurism usually occupies so much space that there is not sufficient room above it, for example, between it and the renal arteries, for the carrying out of any such measure. Ordinarily it would be difficult to obtain more than room enough for the application of a band.

FUNCTION.

Unfortunately there are not sufficient data to enable me to formulate conclusions as to the ultimate usefulness of the limb after ligation of the common iliac.

In Table C is embodied all that we have learned in one hundred years concerning the function of the limb following this operation.

Seven of the thirty-two cases tabulated by Stephen Smith recovered. One of these (Guthrie) belongs to Group III. Of the remaining six cases, one (Deguise) is in Group I, five (Mott, Salomon, Peace, Hey, Garviso) are in Group II.

Deguise's patient left the hospital in five weeks. There is no note of subsequent observation. For the study of function

[a] Jour. of Exp. Med., 1909, Vol. XI, No. 1.

* June 3, 1912. Since going to press one of two dogs operated upon April 29 for the purpose of testing the effect of cuffs and of spiral strips of the fresh aorta of one dog wound about and constricting the aorta of others we examined to-day under ether, and to our delight and surprise found that the aortic cuff which had been used in this experiment seemed to be completely organized and had not, apparently, stretched in the least. The aortic pulse immediately above the constricting cuff was forcible; just below the cuff it was feeble but countable, and at this point a barely perceptible thrill was appreciable. The left femoral pulse could with difficulty be felt and counted by Dr. Goetsch who with Dr. Jacobson assisted me in making the examination, but on the right side (smaller artery) it was questionable whether or not the pulse could be appreciated with the finger. Having clamped all the aortic branches up to the band, it was noted on removal of the clamp from one of the common iliac arteries that the blood trickled feebly and with barely perceptible pulsation from the open end of the vessel. On dissecting the aorta after removal from the body, it was ascertained that the cuff which seemed, as it were, welded to it had not stretched or become thinned or altered in appearance. A fine probe passed into the aorta was snugly embraced at the site of the cuff. The artery was split open at both ends up to the cuff and the fine opening and characteristic wrinkling of the constricted vessel noted. There was almost no reaction about the cuff which seemed to be organized. Even its free flaps had retained their original dimensions.

Another dog, operated upon on the same day and in the same manner, except that a spiral strip of aorta instead of a cuff was used for the band, died suddenly about three weeks after the operation. In this instance the aorta had been almost completely occluded by the spiral band the turns of which had been held by three fine silk sutures, two applied at the pointed ends of the spiral strip and one near its middle. Dr. Jacobson, who kindly took charge of the dogs after operation, removed the specimen which I have just examined. The findings are precisely the same as in the first case. The weld-like band had not stretched, and the aorta, on being split longitudinally, was seen to be greatly wrinkled and almost occluded at the site of the seemingly organized spiral strip. There was no adhesion between the folded intimal surfaces which had been so firmly held in contact.

Thus, perhaps, at last, a safe and reliable method for occluding the aorta has been found, and an interesting and promising field for investigation opened.

Fresh tissues of other kind may serve the purpose quite as well as the aortic cuffs or strips. This remains to be determined. We await the findings of the histological examination of the specimens with much interest.

In similar manner, with bands of fresh tissue, partial and complete obstruction and isolation of the intestine might be produced.

this case might be considered under Group II, for the operation which resulted in the ligation of the common iliac was undertaken for the cure of an inguinal aneurism. It was only in the course of the operation that hemorrhage necessitating the ligation of the common iliac occurred. (Vid. Am. Jour. Med. Sc., Oct., 1841, p. 475.) If this case were transferred to Group II, the mortality for ligation of the common iliac prior to 1860, would be one hundred instead of ninety-one per cent.

Mott's patient, observed 3½ months, stated at the end of this period that his leg was as strong as the other. While the memories of the agonizing pains suffered before the operation were still vivid, it is supposable that he might in his joy at being relieved of his torture and in his desire to emphasize his gratitude to his deliverer have overestimated the relative usefulness of the limb.

It will be observed that my patient, operated upon three and a half years ago wrote enthusiastically of the result a year after being cured, but now realizes that he is considerably incapacitated. Salomon's patient died ten months after the operation from a suppurative inflammation in the course of the psoas muscle on the affected side. It is stated that the patient of Peace was able to provide for his family, pursuing the arduous occupation of loading boats with stones. But about 14 months after the operation, a small, soft, non-pulsating tumor appeared at the site of the aneurism. Perforation of the skin and hemorrhage took place in a few days and in eleven days thereafter he died.

Nothing is known of the cases of Hey and Garviso after leaving the hospital.

Kümmel adds to Smith's list two cases of cure between 1860 and 1880 (McKinlay's, Group I, and Cock's, Group II).

McKinlay's case is not pertinent for the study of function, for the thigh was amputated. In Cock's case there is a note that when seen "a few months after leaving the hospital there were no untoward symptoms," and that he resumed his occupation.

Hence for the septic period only one case (Peace, 14 months) was observed long enough to be considered in estimating the usefulness of the limb.

Of the thirty cases of the antiseptic period, fourteen died. Of the remaining sixteen, seven had gangrene. Of the nine without gangrene (and these, of course, are the only ones to be considered under the heading of function) there is in two (Lucas and Stevenson) no record of observation after the discharge from the hospital. In one (Küster) the operation was performed on a patient incapacitated by elephantiasis. Of the others, Beckman's was observed for two months ("improved"), Martin's for two and one-third months ("could walk about slowly"), McBurney's for three months ("weakness in left leg").

At the end of six months, Jameson's patient walked with difficulty. The hip and knee were flexed.

Clark's patient, observed for nine months, worked as a porter, wheeling a barrow about a railroad station.

My patient is still under observation, three and one-quarter years since the operation. April 4, 1912, he wrote me, "My left leg is a great deal weaker than my right. I can't walk very much as I have pain in my left leg when I do any walking and in case it gets very cold. My present weight is 180 pounds. I have a splendid appetite and haven't been ill since my return. All traces of the aneurism have disappeared and it never worries me the least bit."

Mortality.

Stephen Smith in reviewing the result in the cases of his first group writes:

"Of 11 cases, 10 were fatal, one recovered, being a mortality of nearly 91 per cent. The success of this operation upon the primitive iliac artery for the causes above assigned, presents a striking contrast with the operation upon the external iliac for the same class of diseases and accidents. Of 14 cases of deligation of the external iliac artery for the arrest of hemorrhage, I find that 11 were successful and three fatal, the mortality being about 21½ per cent."

Concerning Group II, he remarks:

"A just appreciation of the results of these 15 cases would give the following conclusions: recoveries, five; permanently cured, one (Mott); temporarily, two (Salomon, Peace); unknown, two (Hey, Garviso); died, ten; fault of ligature, one (Crampton); condition of patient most unfavorable at time of operation, two (Syme, Van Buren); intercurrent disease unconnected with operation, one (Stone); connected with operation, three (Stevens, Jones, Wedderburn); local disease due to operation, one (Stephen Smith); cause of sinking and death uncertain, one (Goldsmith); attributed to operation, one (Lyon).

"The results of the operation of deligation of the common iliac artery for aneurism, as compared with the same operation upon the external iliac, is worthy of notice. In 95 cases, which I have examined, of ligation of the latter artery for aneurism, 69 recovered and 26 died, being a mortality of about 27 per cent, or less than half the mortality of the same operation for the same disease when performed upon the common trunk. The cause of death in 11 cases, or nearly one-half, of ligation of the external iliac for aneurism was mortification of the limb, presenting a striking contrast with the same operation upon the primitive iliac, in which there was but one instance in eight cases."

Dreist collected 52 cases from the septic era; 17 of these are in Group I; 14 died; mortality 82.35 per cent; 35 are in Group II; 26 died; mortality 74.29 per cent. From the antiseptic era (since 1880) he collected 10 cases; five in Group I, with three deaths; mortality 60 per cent; five in Group II, with three deaths; mortality 60 per cent.

I have compiled for the hundred years from 1812 to 1912 (Groups I and II) 76 cases of ligation of the common iliac. Hence three-quarters of a case per year since the first ligation by Gibson. 46 of these were operated upon prior to 1880 (septic era); 30 subsequent to that year.

Sixteen are in Group I; of these three recovered; mortality, 81.3 per cent. Sixty are in Group II; recovered 25; mortality, 58.4 per cent. Of the 30 cases, Group II, of the septic period, 21 died; mortality 70 per cent. Of the 30 cases, Group II, of the antiseptic period, 14 died; mortality 46.6 per cent.

Analysing the 14 fatalities since 1880 (vid. Table D), we find that in three cases only (Fluhrer, Bryant and Judd)

could death be attributed solely to the ligation of the common iliac artery. In all the others there were serious complications, sufficient to account for the fatal termination. In Fluhrer's patient nephritis is given as the cause of death. In Bryant's, no cause is assigned; the report, however, is very brief. Judd's patient did not rally from the shock of the prolonged (three hours) operation. The mortality, therefore, in the uncomplicated cases is at most 10 per cent. Possibly it is only 3.3 per cent.

EPICRISIS.

From the critical consideration of the cases collated in this paper we may, I think, conclude that the uncomplicated ligation of the common iliac artery is not likely to be followed by gangrene, the percentage being from 3.3 to 6.6 instead of 33.3; and that the mortality, contrasted with 60 per cent as estimated by Dreist for Groups I and II, is at most 10 per cent and probably not more than 6.6 per cent; or it may even be as low as 3.3 per cent.

The data are too meager to justify an expression of opinion as to function, my patient being the only one observed for sufficient time. In this man, although there may be no visible signs of disturbed circulation, the fact that he is unable to walk further than a very short distance without cramp-like pain would seem to indicate that the impairment of function should be attributed to ischæmia of the limb.

In Clark's case, at nine months, the function seems to have been good. His patient was only 26 years old.

Notwithstanding the low mortality and the infrequency of gangrene consequent upon ligation of the common iliac for aneurism, the operation is not an ideal surgical procedure, and chiefly, in my opinion, for the reason that it cuts off the direct blood supply from the internal iliac.

Furthermore, the operation under consideration does not invariably cure aneurism. In the eleven cases of recovery since 1880, without gangrene, and in which the operation was performed for aneurism, there was recurrence in one after seven months (Gillette), and of the six cases in Stephen Smith's collection, one recurred after fourteen months (Peace). It is possible that in other cases, also, recurrence would have been noted had the patients been observed for a longer period.

In extirpation of the aneurism we have a means of curing it. But that this procedure, which has rarely been resorted to in the case of aneurism of the external iliac artery is less dangerous, or less or more liable to be followed by gangrene, we do not as yet know. We might, however, predict that the function of the limb would be less impaired by the excision of the sac than by the ligation of the common iliac, because the former operation does not interrupt the circulation in the internal iliac artery.

In the excision of such an aneurism the external iliac would have to be ligated twice and if the lower ligature had to be placed below the deep epigastric and circumflex iliac arteries, the limb would be deprived of the services of these important anastomotic channels. We know, as I have said, but only in a general way, that ligation of the external iliac is much more likely to be followed by gangrene than is ligation of the primitive stem.[20] Furthermore, the enucleation of an aneurism may be difficult and attended with the danger of wounding important veins and of thrombosis of vessels not actually cut or torn.

The ideal operation, as it seems to us at present, is one which causes only so much disturbance of the circulation as is necessarily incident to a spontaneous cure of the aneurism, namely its obliteration.

This is precisely what the Matas operation contemplates. The vessels which are given off from the sac must, in the course of cure, be occluded at their origin, and, presumably to the first collateral branch.

I should suppose, however, that the danger of gangrene after the Matas operation would be at least as great as from ligation of the afferent artery immediately above the aneurism, were it not that the former procedure promptly relieves the patient of the tumor and the pressure which it exerts, whereas after ligation many months may be required for the absorption of the aneurism. Also in favor of undertaking to perform the Matas operation, even in cases which might prove to be unsuitable for it, is the fact that the precise state of affairs becomes investigated and such endeavor not infrequently may result in the finding of a hole in the artery, as in the case of Balch and Murphy,[21] the closure of which will suffice to cure the spurious aneurism. In such case, although the performance of the Matas operation is not indicated and, indeed, not possible, the result will justify the means.

In other words, the condition of the patient permitting, a thorough operative investigation should be made in all cases of aneurism or wound of the external iliac artery.

A fatal termination might have been avoided in a very considerable number of the cases of ligation of the common iliac if this vessel had been temporarily compressed and the precise condition investigated at the first operation.

I should not suppose that the preservation of the vaso vasorum would be important for the prevention of gangrene which, when it occurs, follows operation too quickly for these little vessels to have become serviceable. Maintenance of their integrity might possibly be of value for the preservation of function.

In what has been said, I have not had in mind either the restorative or reconstructive operations of this eminent surgeon. The former of these procedures may have a sphere of great usefulness in saccular and arterio-venous aneurisms, but I have not regarded with much favor the attempts which have been made to reconstruct arteries from the diseased wall of the aneurism. I believe it will be found that modification of the Matas operation may be indicated in many cases, possibly in a considerable proportion of them. It may, for ex-

[20] It would be interesting to try to determine by careful study of the cases, the explanation of this well established fact. It is my opinion, as already indicated, that it may be found in the situation of the aneurism.

[21] Boston Med. & Surg. Jour., 1908, Dec. 24, p. 800.

ample, not always be desirable, even when possible, to approximate the intimal surface throughout. In some cases it may seem better to split the sac longitudinally or otherwise, in one or more places, and to close the several parts of the sac independently. In others the sac may lend itself in part or in toto to excision naturally and without injury to outside vessels, and when this is the case enough of the sac might be left on the stump of the various arteries to enable the surgeon to close their orifices, from the intimal side, if it should seem advisable to do so, with one or more circular stitches or rows of suture.

In cases in which no advantage is to be gained by leaving the sac, it might, perhaps, better be removed. It should, in my opinion, never be drained merely for the sake of drainage. It is conceivable that in rare instances it might have to be packed for the control of hemorrhage, as, for example, in a case of spurious aneurism, when, if the patient were exhausted, it might be unwise to attempt to check every oozing point.

In the case of subclavian aneurisms I am still of the opinion that excision when feasible may prove ultimately to be the best treatment in selected cases. When the sac lends itself easily to enucleation without danger to the contiguous vessels, there should be no added danger attending its extirpation. All of the arteries arising from it can be ligated as they present themselves in the course of the dissection—arteries which in the performance of the Matas operation would either have to be exposed and temporarily clamped, or occluded, less advantageously perhaps, and at times with difficulty in the presence of hemorrhage, from within the sac. In many instances the operators have been greatly embarrassed on opening the sac by hemorrhage from vessels which were not or could not be clamped from without.

Of the cases not located on the extremities, those lend themselves best to the performance of the Matas operation in which all of the arteries leading from the sac can be temporarily clamped outside of it. Now when all of these have been exposed sufficiently for clamping it is not quite clear to me why their permanent closure should be deferred until the sac shall have been opened.

A few days ago, in operating upon an aneurism of the dorsalis pedis artery, the afferent and efferent orifices were less than 1 cm. apart and were easily approximated without tension. An end-to-end suture which in some situations and under certain conditions would be unquestionably indicated was not considered worth while, and it would have seemed absurd not to have excised the readily enucleable sac.

Each aneurism presents its special problems which it may not be possible to solve altogether until the operation has neared completion.

As a general proposition, I should be disposed to ligate permanently, just outside of the sac, all arteries which in the natural course of performance of the Matas operation would be clamped temporarily. And, inasmuch as all arteries leading from the sac should, when feasible, be under the control of clamps (when not controllable by the elastic bandage) before the sac is opened, are there good reasons for not removing under these circumstances a sac which has, in the process of the exposure of the arteries for clamping, become almost enucleated?

I have been unable as yet to convince myself that arteries which have been temporarily occluded in close proximity to the aneurism might not better be tied at once and divided, for thus the arteries still to be sought with the object of temporary occlusion in view become more readily accessible. And when these secondary arteries have been clamped why not ligate and divide them also for the same reason, and so on until all of the arteries, which in the course of the Matas operation would be temporarily occluded, have been tied off?

So much of the sac as, by this time may have been dissected out, might, it seems to me, be removed with advantage unless it could serve some special purpose by being left.

And even in the cases in which the Matas operation seems to be clearly indicated and in which temporary compression of the main artery above and below the sac is contemplated, the dissection necessary for an exposure of this vessel which would be ample for the simple ligation might be insufficient for its temporary occlusion with the necessarily somewhat cumbersome clamps designed therefor.

In the case of popliteal aneurisms especially, and of aneurisms so situated that their blood supply can be completely controlled by tourniquet the Matas operation plays an important rôle. In brief it is particularly applicable to the treatment of such aneurisms of the extremities the extirpation of which might be attended with greater interference with the circulation. In other situations, in the case of easily enucleable aneurisms, the danger of hemorrhage should ordinarily be less with extirpation than with the Matas operation.

Dr. Matas has with great courtesy written me concerning the cases of aneurism of the external iliac and ilio-femoral arteries which have been treated by his method and I await with interest their publication in detail. No one, I am sure, can be more eager than he to determine the precise indications for the operation so brilliantly conceived by him or to suggest modifications of it should they seem to be clearly indicated.

It is undoubtedly the duty of every surgeon to familiarize himself by much practice on animals with the treatment of wounds of the heart and largest blood vessels, veins and arteries, for otherwise he might be unable to cope properly with an emergency which, any day, may confront the active practitioner of this art. I would recommend the making of fistulæ between the aorta and vena cava, the vena cava and portal vein, and between the innominate vessels. Also the practice of the end-to-end suture and the implantation of vessels.

One of the chief fascinations of surgery is the management of wounded vessels, the avoidance of hemorrhage. The only weapon with which the unconscious patient can immediately retaliate upon the incompetent surgeon is hemorrhage. If he bleeds to death, it may be presumed that the surgeon is to blame, whereas if he dies of infection, or shock, or from an unphysiological operative performance, the surgeon's incompetence may not be so evident.

NOTES ON NEW BOOKS.

Nervous and Mental Diseases. By ARCHIBALD CHURCH, M. D. and FREDERICK PETERSON, M. D. Seventh edition. Revised. Illustrated. $5.00. (*Philadelphia and London: W. B. Saunders Company, 1911.*)

Comment upon a work which has reached a seventh edition seems superfluous. Evidently the book finds an appreciative public. A number of changes have been made in this edition which are improvements. The chapters on Meningitis, Aphasia, Poliomyelitis, Pellagra, and Pituitary diseases have been largely rewritten. A section upon Oppenheim's Congenital Amyotonia has been added and a brief account of the various theories as to the nature of Hysteria. Descriptions of the conditions due to reduced pituitary activity have been briefly interpolated, strangely enough, with but scant mention of Cushing's work. In the section upon Mental Diseases the résumé of the principles advanced by Wernicke, Ziehen, and Kraepelin which graced the fourth edition and which was written by Meyer, has been omitted. Possibly this was found to be too advanced for the public appreciating this work.

Judged from the standpoint of the student and practitioner, for whom this work was written, the present edition is fully up to the standard. There is much more to commend than to criticise. Numerous illustrations of an exceptionally excellent character add greatly to the usefulness and attractiveness of the book.

W. R. D.

Diseases of the Stomach. With Special Reference to Treatment. By CHARLES D. AARON, Sc. D., M. D. Illustrated. $4.75. (*Philadelphia and New York: Lea & Febiger, 1911.*)

Nearly one-half of this work is introductory to the chapters dealing with the actual diseases of the stomach. The author first discusses the physiology of digestion, the examination of the stomach, contents, diet, methods of treatment, etc., and then passes on to the consideration of the various neuroses of the stomach to which he devotes about a hundred pages, and the final one hundred and fifty pages to the more strictly organic diseases. Treatment, as indicated in the title, is the part on which the author lays most stress, and from this point of view the average practitioner will find the book useful. The book does not add to our knowledge of stomach diseases, but the author has gathered much information together in a clear way and written a work which will doubtless prove attractive to the students from its simplicity.

Dysentery in Fiji, During the Year 1910. By P. H. BAHR, M. B., etc. Supplement No. 2 of The Journal of the London School of Tropical Medicine. Illustrated with Plates and Charts. 6/. (*London: Wetherby & Co., 1912.*)

This short monograph is important as it adds to our knowledge of the prevalence of one of the common tropical diseases in a country with which there are large commercial relations, and from this point of view such reports are of very distinct value. The more detailed information we have in regard to the existence of a disease, the greater is our power to control it, and to prevent those exposed to it contracting the malady. Such a study is one of the best results of the school which gave birth to it.

Compendium of Diseases of the Skin. With a Therapeutic Formulary by L. DUNCAN BULKLEY, A. M., M. D., etc. Fifth Revised Edition. $2.00. (*New York: Paul C. Hoeber, 1912.*)

Under a new name Dr. Bulkley presents his manual which has been so widely known and appreciated for many years, especially by the student and general practitioner. As a result of the wide experience of the author his therapeutic formulary is most helpful, as the treatment of skin diseases is usually a serious stumbling block for the physician. Dr. Bulkley's description of diseases is brief but clear, and as a very concise manual there is none better in English.

The Technique and Results of Radium-Therapy in Malignant Disease. By M. DOMENICI, M. D., Paris, and A. A. WARDEN, M. D., Glasgow and Paris. 75 cts. (*London: J. and A. Churchill; Philadelphia: P. Blakiston's Son & Co., 1912.*)

This is merely a very brief reprint of an article from the British Medical Journal, 1910, with additional plates and more recent notes. It is interesting as showing the success attained by this means of therapy in a few cases, only seven, of lymphadenoma, sarcoma, and epithelioma.

Duodenal Ulcer. By B. G. A. MOYNIHAN, M. S. (London), F. R. C. S. Second edition, enlarged. Illustrated. $5.00. (*Philadelphia and London: W. B. Saunders Company, 1912.*)

On its first appearance this book was favorably reviewed in our columns (August, 1910), and it is not at all surprising that a second edition has been called for. Dr. Moynihan has made this disease a life-long study, and the results of his work are invaluable to other surgeons. "The changes in the text in the second edition of this work have been chiefly concerned with the differential diagnosis of duodenal ulcer and the result of X-ray examinations of the stomach after the administration of bismuth." (Preface.)

Treasury Department. Public Health and Marine-Hospital Service of the United States. Reprint from Public Health Reports, No. 70. Municipal Ordinances, Rules and Regulations Pertaining to Public Hygiene. Adopted from January 1, 1910 to June 30, 1911, by cities of the United States having a population over 25,000 in 1910. (*Washington: Government Printing Office.*)

This pamphlet will be of very great service to the governing boards of town and cities, and to many organizations interested in public hygiene. The study of what has been accomplished by others shows us how much we can do ourselves, and the example set by some cities in bettering social conditions is a great stimulus to others in undertaking similar or new work. These rules, etc., cover the questions of communicable diseases, poliomyelitis, vaccination, spitting, street cars, drinking cups, food stuffs, milk, meat, garbage and a number of other vital problems. It is a satisfaction to note how the cities are awakening to the importance that all these questions have for the health of their citizens.

Pellagra. By GEORGE M. NILES, M. D., Professor of Gastro-enterology and Therapeutics in the Atlantic School of Medicine, Atlanta, Georgia. Illustrated. $3.00. (*Philadelphia and London: W. B. Saunders Company, 1912.*)

Up to a very recent time there was good reason why pellagra should not be recognized by the average practitioner in the regions where it mainly was seen. It had not been described as an American disease, and its various stages and forms did not appear to group themselves together, so as to become a recognizable unit. But from now on there will be less and less excuse for mistakes being made in the diagnosis of this disease. Already several works on the subject have appeared in English, and with this last addition to the bibliography, every physician has the means to become thoroughly acquainted with the symptoms. It is to be hoped that the doctors throughout the south will study Dr. Niles' book with care, for he presents the matter in a clear and interesting way. He is a firm believer in the zeist theory of the origin of the

disease, and whether the future proves this to be the real cause or not, does not diminish the value of his book. There is much uncertainty still, in spite of all the foreign studies of pellagra, in regard to various features of this disease, but the author gives all the evidence at hand, especially in regard to the mental symptoms, which may help to enlighten the student. From his own large experience, and from a wide reading of the literature on this subject, Dr. Niles has written an important contribution.

The Surgical Clinics of John B. Murphy, M. D., at Mercy Hospital, Chicago. Vol. I. No. 2. April, 1912. (*Philadelphia and London: W. B. Saunders Company, Published Bi-monthly.*)

With this publication and a series of papers appearing in the Journal of the American Medical Association the work of Dr. Murphy is securing very wide notice, and we regret that the Surgical Clinics are not better constructed. Were cases so grouped that deductions as to treatment, etc., in a variety of conditions might be correctly drawn, then these clinics would be of real service. But to read a number of case histories which have no close connection one with another, many of them reported but briefly, is a waste of time.

Tumors of the Jaws. By CHARLES L. SCUDDER, M. D. Illustrated. $6.00. (*Philadelphia and London: W. B. Saunders Company, 1912.*)

Dr. Scudder in his preface states that there is no complete treatise on this subject in the English language, and his book, which is based in measure on the extensive records of the Massachusetts General Hospital, will prove most useful to the profession. It has been compiled with the author's well-known care and scholarship, and the statistics he has gathered and the cases he reports in brief make it especially valuable. "Tumors of the Jaws" is an important addition to surgical literature, and paves the way for other larger works on the subject or monographs on some of its special features. There are nine chapters on the following subjects: 1, epulis; 2, sarcoma of the jaws; 3, benign tumors of the jaws; 4, the odontomata; 5, carcinoma of the jaws; 6, the diagnosis and operative treatment of malignant disease of the upper and lower jaws; 7, tumors of the palate; 8, leontiasis ossea; and 9, prosthesis, followed by an index of names and index. The two longest chapters are those on sarcoma (100 pages) and odontomata (80 pages). The work is very abundantly illustrated, in this respect being the most remarkable collection of horrible pictures that we know of in any surgery. One of the blessings of modern surgery is the possibility of preventing persons ever becoming such monstrosities as are here portrayed. Many a surgeon and physician will turn away with loathing from these repellent pictures. The book is a gallery of horrors. The reproduction of these photographs may well be a question of taste and value, but it is impossible not to express our intense dislike of the selection of a frontispiece of the most hideous deformity of the human countenance in colors; elsewhere in the book it might have been tolerated, but to open on this is positively repulsive. As a piece of book-making, the publication is, we think, poor; heavy shiny paper, with very wide spacing between the lines of the text, and no use of different sizes of type to indicate the body of the text from case histories and statistics, thus making the volume much larger and heavier than necessary. The text is also so broken by the innumerable pictures as to make tedious reading. When will publishers cease to produce expensive works, which could be sold to many more readers were the price less? This is, for the doctor, one of the high costs of living.

Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India. By MAJOR D. MCCAY, M. B., etc. Investigations into the Jail Dietaries of the United Provinces with Some Observations on the Influence of Dietary on the Physical Development and Well-Being of the People of the United Provinces. New Series. No. 48. Price 3/. (*Calcutta: Superintendent Government Printing, India, 1912*).

A short time since Major McCay, who is professor of physiology in the Medical College, Calcutta, prepared a similar report on the jail dietaries of Bengal, noticed in our issue of February, 1911. Such a report is of value to the Indian Government, but will find few readers except medical officers in India, and possibly some others interested in these physiological problems.

Epidemic Dropsy in Calcutta. Being the Final Report of an Enquiry Carried Out by MAJOR E. D. W. GREIG, M. D., etc. New Series. No. 49. Price 2/6.

The preliminary report was reviewed in our columns, January, 1912. The two papers make a valuable addition to our knowledge of this disease in an Eastern community.

Sprue: Its Diagnosis and Treatment. By CHARLES BEGG, M. B., etc. Illustrated. (*New York: William Wood & Co.*)

Doctors who may go to the tropics to practice, and army and navy surgeons who at any moment may find themselves in these regions, will find helpful this new study of an obscure malady, for Dr. Begg writes after "over thirty years' clinical work in connection with this disease" (though he does not state where he has practiced). The author considers the geographical distribution, morbid anatomy, pathology, diagnosis and treatment of the disease, with additional chapters on cases, results in his last hundred consecutive chronic cases, and dysentery. He recommends strongly the use of *yellow* santonin, which he believes to be the most efficacious of all drugs in this disease. It must be left to other doctors to pursue this treatment further and determine its ultimate value. It is a brief monograph, which might have been easily, and with benefit, published in a volume of half the size of the present. Although stated to be illustrated it has only a few micro-photographic reproductions.

Report from Pathological Department and the Department of Clinical Psychiatry, Central Indiana Hospital for Insane. 1909-1910 and 1910-1911. Vol. IV. (*Indianapolis: Wm. B. Burford, 1912*).

We have noted before with satisfaction and pleasure the preceding volumes issued from this hospital, and are glad to again call attention to the work done in the above-named departments. Drs. Martin and Bahr, pathologist and psychiatrist, deserve much credit for the full reports from their divisions. They are adding valuable information along lines of work often neglected in insane hospitals, where the constant loss of material for scientific study is to be much regretted. The directors of many insane hospitals think that scientific workers in their institution are merely a needless expense, but it is gratifying to note that Dr. Edenharter, the superintendent of this hospital, recognizes how important such workers are to the welfare and fame of his institution, and that he has been able to obtain the means to support these men and has secured such active workers. With this start we are confident that these reports will win greater recognition in the future, and the State of Indiana is to be congratulated on the work done in this hospital. The appearance of the report, both in binding and printing, is exceptionally good.

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